

HOLLOW TILE
FIRE CLAY
FIREPROOFING
IN MODERN BUILDING
CONSTRUCTION

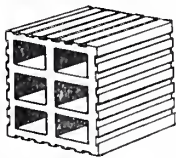


THE WHITACRE-GREER
FIREPROOFING COMPANY
WAYNESBURG, OHIO

SECRET LIBRARY



HOLLOW TILE *FIRE CLAY* FIREPROOFING IN MODERN BUILDING CONSTRUCTION



THE PATENT PLASTER CO.
SYRACUSE, N. Y.

THE WHITACRE-GREER
FIREPROOFING COMPANY
WAYNESBURG, OHIO





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WHERE WHITACRE-
GREER FIREPROOFING
IS MADE

- (1) Plants Nos. 1 and 2,
Waynesburg, Ohio.
- (2) Plant No. 3, Malvern,
Ohio.
- (3) Plant No. 5, Magnolia,
Ohio.
- (4) Plant No. 4, Chicago
Heights, Ill.



The Advantages of Hollow Tile Construction

ORIGINALLY developed for the protection of the skeleton steel framework of large buildings against fire and corrosion, a purpose which it effectively accomplishes, hollow tile has today assumed a variety of uses limited only by the builder's requirements and the architect's ingenuity.

Hollow tile is in universal use and there is scarcely a structure in which it cannot be used to advantage and with an ultimate saving in cost.

Back of this growing popularity we find certain advantages peculiar to this type of material:

1. Strength Any standard fire clay hollow tile product will develop a crushing strength far in excess of the average good cement mortar. Thus it will be seen that the load-bearing capacity (and the capacity to resist stress) of the properly constructed hollow tile wall is limited almost solely by the strength of its mortar joints.

Load bearing walls of all normal heights, constructed of hollow tile laid in a fairly rich Portland cement mortar with properly bonded joints, will support a load of from five to twenty times the weight of the wall itself with an ample factor of safety.

The strong natural bond between hollow tile and cement mortar is further increased by deep dovetail grooves.

2. Fire Resistance

Hollow tile, requiring high temperatures in its production, naturally has a very high resistance to the action of fire. Numerous conflagrations in which it has been subjected to extreme tests have proved that it will withstand abnormally high temperatures without cracking, disintegrating or losing its strength.

A further degree of fire protection is provided by the cells

and the fact that fire clay is not a conductor of heat.

3. Lightness A cubic foot of hollow tile weighs only one-half to one-fourth as much as the same volume of other structural materials.

The use of this material, therefore, materially reduces dead weight, without sacrificing strength, and effects a considerable saving in shipping costs.

4. Ease of Laying Hollow tile, in even the largest sizes, is considerably lighter than brick or stone of equal volume. This comparative lightness, together with the wide variety of shapes and sizes to meet almost every architectural requirement, facilitates laying and effects important economies in construction.

5. Insulating Value The dense clay used in the manufacture of hollow tile products is of itself a very poor conductor of heat and cold, while the dead air in the cells absorbs and neutralizes any cold conducted through the material itself.

The insulating value of hollow tile walls is governed by three factors—density of material, thickness of webs and shells and number of cells. Thus an eight-inch load bearing wall has far greater insulating value than one of four-inch or six-inch load bearing tile, or even an eight-inch partition wall.

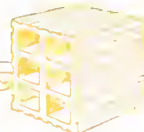
A structure of properly laid hollow tile with all openings well caulked provides one of the most economically heated buildings it is possible to construct. Likewise the hollow tile wall is vermin proof and sound proof.

6. Low Finish Cost

The deep dovetail scoring provides a perfect base for stucco or plaster finish and the natural bond between tile and finish works to-



Cleveland Public Library, Cleveland, Ohio.
Walker & Weeks, Architects.
Lundoff-Bicknell Co., Contractors.





ward greater permanence of the finished wall. The tile also provides a rigid base for the finish, facilitating its application.

7. Dryness The absorptive factor of fire clay hollow tile is so low that it may be ignored for walls above grade. The following test illustrates the absorptive factor of Whitacre-Greer fire clay tile:

Absorption Test

Conducted by Pittsburgh Testing Laboratory, Pittsburgh, Pa.

Laboratory No. 49557—Date, Aug. 25, 1922.

Tile dried and immersed in water 24 hours.

Type of Tile	Original Dry Weight of Section, Grams	Weight After 24 Hours Submersion, Grams	Weight Gained, Grams	Per Cent of Gain
6 cell, 12"x12"x12"				
Load Bearing.....	19,335	20,400	1,065	5.50
6 cell, 8"x12"x12"				
Load Bearing.....	2,265	2,330	65	2.87
4 cell, 10"x12"x12"				
Partition	4,150	4,390	240	5.78
1 cell, 5"x4"x12"				
Backup	3,720	3,980	260	6.99
2 cell, 5"x8"x12"				
Backup	6,595	6,880	285	4.32

8. Uniformity Only one ingredient enters into the manufacture of Whiteacre-Greer fireproofing—fire clay—without mixing or compounding with other clays or shales.

Controlling our own immense clay mines in the rich clay section of Ohio, we are able to maintain unvarying quality in the raw material, assuring uniformly high quality in the finished product.

9. Permanence

The hollow tile wall requires no attention or expense to maintain it at its highest efficiency. The dismantling of many old buildings shows the hollow tile to be unaffected by time and the elements.

In many cases where it was found possible to keep the tile intact during wrecking operations they have been sold by the wrecking companies to be used again.

10. Low Depreciation There is no depreciation in hollow tile itself. The little depreciation there is in the hollow tile wall comes in the cementing medium, although this is almost as permanent as the tile itself and is usually protected by the finish or veneer. As far as time and the elements are concerned, the hollow tile wall will stand forever.

11. Varied Use There is practically no limit to the practical and economical usefulness of hollow tile. Foundations, piers, walls and floors in residences, apartments, warehouses, mercantile buildings, schools, factories, farm buildings, garages, etc., are but a few of its uses, while there is scarcely a modern business or office structure in which hollow tile does not enter largely into the construction.

The Advantages of Fireclay Hollow Tile Fireproofing

All Whitacre-Greer fireproofing products except that part of our production coming from our Chicago plant is manufactured from the best grade of Ohio fire clay. Fire clay is very dense and burns at a higher temperature than ordinary shale, firing a rich buff color while the shale fires red.

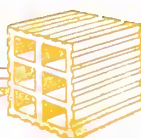
Fire clay hollow tile combines all the advantages of hollow tile previously enumerated, but by reason of its density, higher burning temperature and other qualities peculiar to the clay itself, these are increased in degree.

The greater density of the clay decreases the absorption factor and adds to its ability to resist the elements. Another important advantage of the fire clay product is its immensely greater fire-resisting value. Fire clay requires a considerably higher temperature for firing than ordinary shale or surface clay. Its greater resistance to fire is thus clearly evidenced.

Finally the uni-



Furniture Mart Building, Chicago, Ill.
Henry Raeder, Architect.
Welle Bros., General Contractors.



form shrinkage of the clay in burning insures greater uniformity in the finished tile.

Hollow Tile Construction Practice

It is essential that certain general rules be followed to secure maximum effectiveness from the hollow tile wall. These are discussed briefly below together with suggestions for the use of the material which will prove helpful to the architect and builder.

Bonding Any bond which gives sufficient strength to the wall and which will lay to advantage is generally acceptable for walls which are to be stuccoed or veneered.

Sizes of material, corner blocks, openings etc., will determine to a large degree the bonding.

A full running bond equal to one-half the length of the units used (usually six inches) provides the strongest wall and is the simplest to lay. Half jamb blocks are adapted to this type of bonding.

Where walls are not to be finished, the bond must be chosen to provide an even working out of courses between openings and at the same time to conform and align with the bond employed throughout the rest of the wall. For this type of wall, a running bond of one-half the length of the units used is generally the most satisfactory and the sizes and layout of openings should be made to conform as far as possible with the bonding.

Mortar Best results in hollow tile construction are obtained by using a cement mortar composed of one part by volume of Portland cement to three parts clean, sharp sand. The addition of hydrated lime, not exceeding 15% by volume of the cement, makes the mortar more plastic and easier to handle and decreases its tendency to absorb moisture.

Footers Footers for hollow tile foundation walls, etc., may be constructed of concrete poured in wood or metal forms or may be built up from the hollow tile, using larger sizes, double rows of the same size or the same size laid flat to give the proper width.

Care must be taken to lay the tile in a full bed of mortar with full mortar joints to prevent seepage of dampness. Such footings afford a natural drainage, carrying the water away from the walls.

Waterproofing Hollow tile foundation walls laid with full sealed joints have been found perfectly dry, even in damp ground. As a matter of caution, however, they may be waterproofed and waterproofing is advised when walls are built in occasionally saturated soil.

The best method is to rough plaster the outside of the wall with Portland Cement mortar, applying just enough to fill the grooves. The waterproof coat, (any good waterproofing compound) is then applied on this, followed by a quarter-inch protective coat of Portland Cement mortar. Care must be taken that the entire surface is fully waterproofed. Back-filling should be done with care to prevent injury to the coating.

Painting the exterior of the wall with molten tar or pitch is a cheaper though less effective and less permanent method.

Sloping the ground away from the wall and providing a good sod serves to carry away much of the surface water.

Openings Joints may be set flush or recessed, as desired. Flat arch, reinforced tile and concrete or structural steel lintels should be used in all types of walls, although it is permissible to build on the bucks in light partition walls of medium height.

Caulking Hollow tile, if properly laid, seldom if ever gives trouble from dampness. Care in setting and caulking window and door frames will elimi-



Union Trust Co. Building, Cleveland Ohio.
Graham, Anderson, Probst & White, Archts.
Thompson-Starrett Co., Bldg. Construction.



nate the only important source of dampness.

Provision for caulking should be made by leaving a groove for it which may later be covered with staff mold. There are a number of good methods of caulking from which the architect or builder may select to suit his preference.

Floor Supports The wide variety of material permits the construction of pockets for joists in the load-bearing hollow tile wall and filling with the same material between joists, with practically no reduction in bearing area. Tile bearing slabs should be specified where the wall-tile are laid with cells vertical.

Joists should always bear at least four inches on the wall and wood joists should have a three-inch fire cut.

Lean-to Roofs Provision for attaching the roofs of porches or lean-to structures should be made by the use of bolts or anchors built into the wall. When the wall is completed, a wood nailing strip is fastened to the face of the wall by means of these bolts, or anchors. The wood rafters, or other members, are then spiked to this nailing plate.

Piers Porch piers as well as load bearing piers, built free standing, may be constructed of hollow tile. The load bearing capacity of piers may be increased by filling the

cells with concrete poured from the top of the completed pier. Railings or walls between such piers may also be constructed of tile.

Pilasters and Buttresses Hollow tile pilasters and buttresses may be bonded into the wall proper. While the two-inch projection is probably the most satisfactory from an architectural standpoint, any desired projection by two-inch steps may be obtained through the use of standard material.

Belt Courses Belt courses should not extend entirely through the wall as they tend to weaken it. The most satisfactory belt is the concrete core covered with stucco.

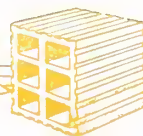
The concrete core is run in a form constructed of wood strips of the thickness the belt is desired to project. The inner edges are tapered in and the strips spaced to the desired width of the belt, less twice the thickness of the stucco coat. These are fastened to the tile wall by means of thin nails driven into the mortar joints and are removed after the concrete has set.

The stucco is applied to this concrete core at the same time that the main wall is stuccoed.

Sills Face brick, laid on edge, properly pitched and grouted solidly in place with cement are preferable to wood sills in



Home of Mrs. D. H. Wallace, Sewickley, Pa.; Robert Maurice Trimble, Architect.



hollow tile construction. Sawed limestone or concrete sills properly set are equally satisfactory. Window sills may be of the same materials, although a very practical sill for stucco finished walls is constructed of hollow tile, wider than the thickness of the wall (to give the proper projection), properly pitched and grouted in cement.

Supporting The Roof A two-inch wood wall plate, anchored to the tile wall by bolts spaced not over seven feet apart and extending down not less than two courses should be provided, to which the rafters are spiked.

The roof construction should be well braced and tied together to prevent outward stress on the walls.

Fireplaces and Chimneys Chimneys should be footed at least six inches to eight inches wider than the finished chimney all around. All chimneys should be enclosed on all sides with a four-inch tile wall extending from the top of the fireplace to the roof, and lined with terra cotta flue lining.

Joists or rafters should never be built into chimney flues, but should be trimmed around them.

The Wall Finish

Brick Veneer Finish Hollow tile, by reason of its strength, insulating value, dryness and light weight, is the perfect backing for brick veneer walls.

Provision should be made for the proper bonding of the materials. While metal ties may be used for this purpose in walls of normal height, the solid masonry bond is to be preferred.

All standard material is made in sizes which will permit the bonding of the two materials by the use of standard brick header courses without the use of special material.

The hollow tile backing produces a wall of great strength and elim-

inates the unsightly cracks which so often occur in the brick veneer when the frame backing is used.

Cement Stucco While the artistic effects obtainable through the use of this type of finish carry a strong appeal, there are those who hesitate to use it because they have seen stucco finish cracking and dropping from frame and masonry structures which do not afford a proper bond.

Hollow tile is the ideal material for stucco walls. The natural bond between the two materials is further enhanced by the strong mechanical bond produced by the dovetail grooves. Stucco will not crack or fall off hollow tile walls. The hollow tile cannot expand, contract, or disintegrate under the stucco and contains no soluble salts or other chemicals which will tend to destroy the finish. The low absorptive factor of the tile prevents the rapid extraction of the moisture from the stucco coat and allows it to set properly.

No material containing soluble salts should be used in mortar as these salts work through the stucco, disfiguring the exterior.

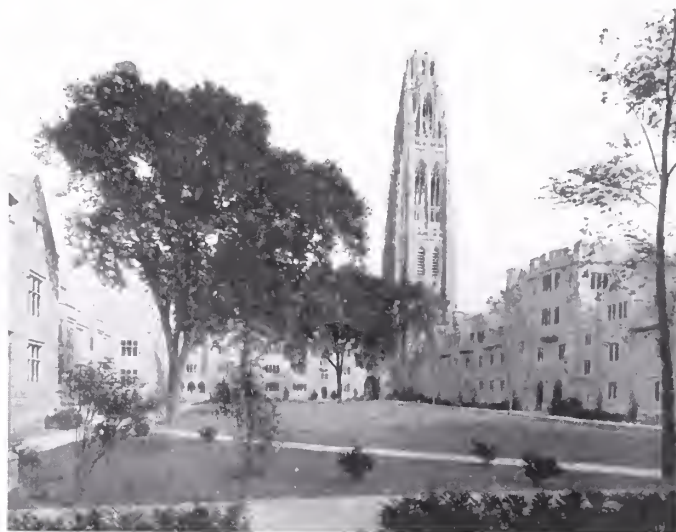
A rich mortar should be used in laying up the tile wall, as a porous mortar absorbs the water from the stucco, causing the surface opposite the joints to dry out more rapidly than the remainder of the stucco coat and show a slightly different color.

Magnesite Stucco Composition The same qualities which so admirably adapt hollow tile for cement stucco finish make it an ideal base for Magnesite Stucco finishes.

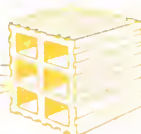
No lime should be used in walls intended to be finished with this material and the manufacturers' directions should be rigidly followed in their application.

Interior Plaster Finish may be applied directly to the tile.

Where a plastered wall is not desired, smooth-faced tile may be used and painted with cold-water paint, white wash or special wall enamel.



Yale Quadrangle, New Haven, Conn.; James Gamble Rogers, Architect; Marc Eidlitz & Sons, Builders.





Products

Our production includes the following hollow tile products:

Partition Tile	Segmental Arch Material
Load Bearing Tile	Skews
Jamb Blocks	Inters
Slabs	Split Furring
PERFECTION Backup Block	Book Tile
Back up Tile	Column Covering
Corner Blocks	Square Corner
Jamb Blocks	Round Corner
Hollow Brick	Round Column Covering
Floor Tile	Radial Brick
Flat Arch Material	Salt Glazed Hollow Block
Skews	Corner Block
Inters	Jamb Block for steel sash
Keys	
Soffits	
Angle Tile	
Shoe Tile	

Manufacturing Facilities

We are the largest independent hollow tile manufacturers on the Western hemisphere.

We operate five large plants having a total of eighty-three round and two continuous kilns, all of which are devoted exclusively to the manufacture of hollow tile fireproofing. Our Ohio plants are located in the rich clay section of the state, where we have thousands of acres of clay land in reserve.

As the clay is overlaid with a three-foot vein of coal which is mined at the same time as the clay we are able to operate entirely unaffected by mining and shipping conditions.

Our four plants have a total capacity of 30,000 tons of material per month, with reserve equipment which permits a considerably larger output when necessary.

We carry large quantities of standard material in our extensive storage yards and are usually able to make immediate shipment of most standard items in moderate quantities from stock.

Railroad Facilities

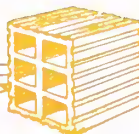
Our Ohio plants are located on railroads having direct rail connection with all the leading trunk roads, serving the eastern section of the United States. An abundant supply of freight cars is available at all times. Our Chicago plant has direct connection with all of the network of lines centering around this great railroad center.

Engineering Service

Our engineering department is composed of practical construction engineers and architects with a thorough working knowledge of fireproof building construction. In addition to assisting in estimating requirements from blueprints, they are able to offer valuable information bearing on the selection of the proper material and its application.

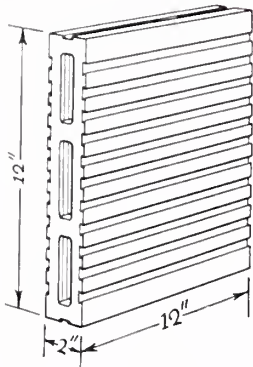


Standard Oil Co., Baltimore, Md.
225' 0" x 12' 0".
The Heine Chimney Co., Builders.

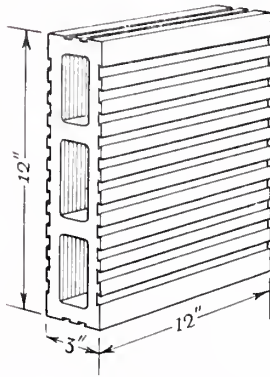




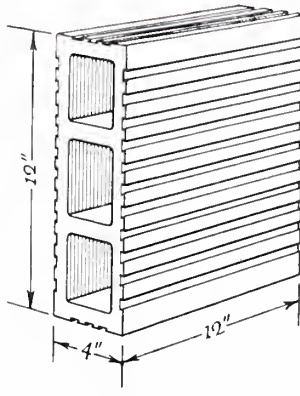
PARTITION TILE



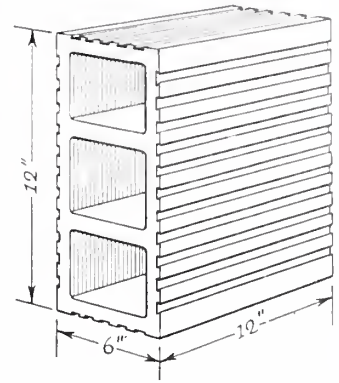
2"x12"x12"
3 cell
Wt. Approx. 15 lbs.



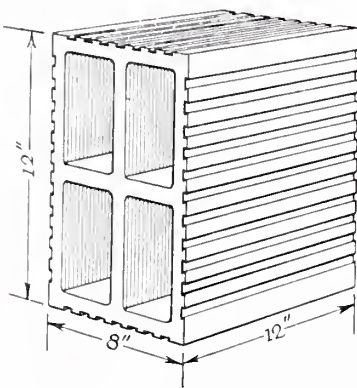
3"x12"x12"
3 cell
Wt. Approx. 15 lbs.



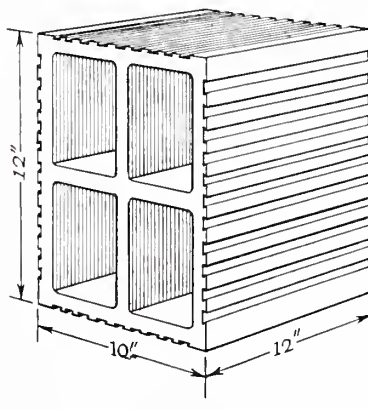
4"x12"x12"
3 cell
Wt. Approx. 16 lbs.



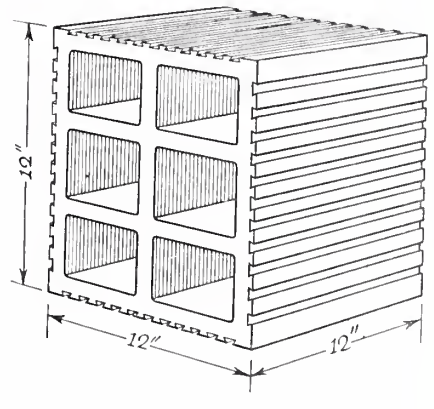
6"x12"x12"
3 cell
Wt. Approx. 22 lbs.



8"x12"x12"
4 cell
Wt. Approx. 30 lbs.



10"x12"x12"
4 cell
Wt. Approx. 36 lbs.



12"x12"x12"
6 cell
Wt. Approx. 40 lbs.

Uses

Partition tile are scored for plaster on four sides and may be laid with cells either horizontal or vertical.

In addition to their use in the construction of interior partition walls, this type of material also serves the following purposes:

Furring out walls where split furring does not provide ample depth.

As a base for concrete cellar and garage floors.

In combination tile and reinforced concrete floors.

Backing up stone or brick veneer walls where

the load bearing requirements of the wall will permit.

Covering steel columns.

As fillers in fireproofing steel girders.

Compression Test Standard Partition Tile

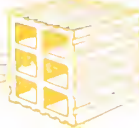
Conducted by Pittsburgh Testing Laboratory
Pittsburgh, Pa.

Laboratory No. 49557. Date Aug. 25, 1922.

Cells horizontal under load.

Type—8"x12"x12", 4 cell

Test Piece	Cross Sectional Area, Square Inches	Crushing Load, Pounds	Crushing Strength, Pounds
1.	97.20	154,500	1589
2.	97.20	184,100	1894
3.	97.20	167,600	1724



PARTITION TILE

Interior Partition Walls

Interior Partition Walls of hollow partition tile laid in cement mortar or rich cement-lime mortar are the accepted standard in all types of fireproof construction where the partition is not called upon to bear any of the weight of the ceiling or super-structure.

Where the partition wall is also a bearing wall, standard load bearing tile having at least three continuous webs or shells should be specified.

Wherever properly constructed, dividing walls of partition tile have withstood the severest fire tests.

There are two types of non-bearing partition walls.

1. Main partition walls, which also serve as fire walls, and for the enclosing of stair and elevator wells, pipe and stack shafts or storage vaults.

Where the story height and distance between anchorages will permit, the ordinary six-inch partition tile is accepted for this class of walls in fireproof skelton-frame buildings. While the four-inch partition wall is also approved, its use should be limited to situations requiring the conservation of space. In structures where the fire hazard is greater, only tile having at least three continuous webs or shells in the cross section of the wall should be used.

This calls for the use of 8"x12"x12" or larger tile.

This type of partition must be constructed as an integral part of the fireproof structure, being built on the fireproof floor arch or fireproofed steel beam and wedged tightly against the ceiling.

Wood frames, wood nailing blocks, wood lintels or bricks are not permitted, when this type of partition wall is used in fireproof structures or is constructed to serve as a fire wall.

Full porous nailing grounds should be employed and structural angle or "T" iron lintels or flat tile arches constructed of our flat arch material used. For very wide openings structural steel or reinforced concrete and tile lintels are standard.

2. Ordinary fire resistive sub-dividing walls, closet walls and free standing furring.

This type of partition wall may be constructed on the top of finished floors of wood or other material where building laws permit the use of such combustible materials, and does not require the use of lintels, except over wide openings, the wall above the opening being built upon the wood or metal bucks. Such sub-dividing walls should not be bonded into bearing walls or column covering, as the latter part of the fireproof structure must always stand independent and intact. Adherence to this rule also facilitates changing or removing of sub-dividing walls to meet future requirements in the matter of rooms or divisions. For the same reason this type of wall construction should not be wedged to the fireproof ceiling.

Anchoring All partition walls of either type should be anchored into bearing walls, piers or column covering where they meet by the use of metal ties or U-shaped clips which are slipped over the shells as the courses are laid. Where partition walls meet or cross, they should be bonded together, although where future alterations in the layout of sub-dividing walls seem a certainty, it is best to merely anchor these walls to the main dividing walls, in the matter described above.

Bracing In unbraced partitions of greater length, or light partitions higher than recommended, or where the walls are subject to jars from heavy swinging doors or machinery located nearby, it is wise to use one of the approved forms of reinforcing material.

Maximum Height For Partition Walls

Size of Tile	For Partition Walls	For Enclosing Walls
3"x12"x12"	12'0"	-----
4"x12"x12"	16'0"	-----
6"x12"x12"	20'0"	-----
8"x12"x12"	26'0"	24'0"
10"x12"x12"	30'0"	30'0"
12"x12"x12"	36'0"	36'0"



PARTITION TILE Combination Floors

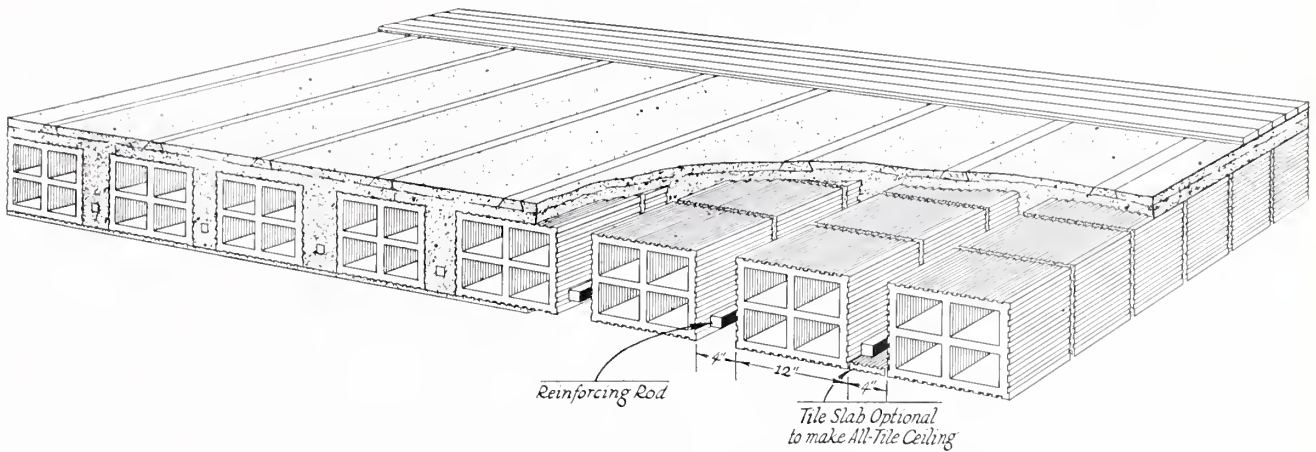


Fig. 1—Section of Combination Hollow Tile and Concrete Floor, showing method of construction with or without All-Tile Ceiling.

Because of the very low dead load developed and its great strength, permitting of long span floors without the necessity of large cross beams, this type of reinforced concrete and hollow tile floor construction is admirably suited to use in structures where it is desired that all floor weight shall be borne by the exterior and partition walls without interior piers or columns and girders.

It is also used to decided advantage with reinforced concrete frame construction, the thickness of the floor permitting the most economical design of "T" girders. Stopping the tile fillers at any distance from the girder stem required by the "T" width permits the use of flanges of the full thickness of the slab, thereby eliminating the wide, thin "T" flanges which limit the design of the "T" girders in solid-slab construction.

The use of the tile fillers produces a floor of connected four-inch reinforced concrete "T" beams spaced 16 inches on center, eliminating more than one-half of the dead weight developed by solid slab construction and producing a span of tremendous supporting strength.

The reinforced concrete "T" beams carry the weight of the floor, the tile serving merely as a form for the pouring of the concrete and a filler between the concrete beams in the finished floor arch.

Their naturally strong adhesive tendency forms a strong bond between tile and concrete, strengthened by the deep dovetail scoring of the tile. This natural adhesion provides all the advantages of monolithic construction, preventing cracking of the floor slabs or plastering applied to them due to temperature changes. Stresses

due to these changes are absorbed where they originate and not transmitted to the anchorage points.

The All-Tile Ceiling The use of tile slabs to form an all-tile ceiling, while it provides greater protection for the reinforced concrete, reduces the carrying capacity of the beam or joist by decreasing the beam depth and the depth at which the reinforcing bars are placed from the top of the slab. This however, may be overcome by increasing the depth of the floor slab by the thickness of the tile slab. When the tile slabs are used, care must be taken to allow space for the concrete to flow between reinforcing rod and slab.

Electric Conduit Electric conduit and piping may be bedded in combination flooring in the same manner used in the solid slab method of construction. Care, however, should be taken in designing the layouts of conduits and pipes to avoid diagonal or cross runs through the compression area, and thinner tile fillers should be used where there is a concentration of conduits and pipes to provide a greater thickness of concrete.

Method of Construction The one-way system illustrated is the most practical and efficient for long span combination floors. The tile are laid end to end in a line of units, a four-inch interval being allowed between lines for the concrete fill. By following this method the units are all in contact and hold each other securely in place during the pouring of the concrete. Realignment is rarely necessary.



PARTITION TILE

Designing Data—Long Span Combination Floors

First figure, T, denotes depth of tile; second figure, R, indicates area of reinforcing steel required in each concrete joist.

For floor slabs freely supported at both ends (simple span) use load given opposite WL/8.

For slabs freely supported at one end and continuous over other support use loads given opposite WL/9, or if building code permits, WL/10.

For slabs continuous over both supports use loads given opposite WL/10, or if building code permits, WL/12.

In semi-continuous spans, proper reinforcement must be provided in top of slab over support to take care of negative bending moment.

Where heavy loads and short spans occur, the vertical and longitudinal shear must be determined and shear reinforcement provided where necessary.

Table based on f.c. 650 lbs. per square inch; f.s. 16,000 lbs. per square inch. 2" Concrete Top Slab. $\frac{3}{4}$ " of Concrete below reinforcement. 4" Concrete Joists, 16" O. C.

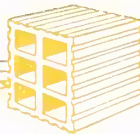
Bending Moment	Total Safe Loads—Live and Dead																							
$\frac{WL}{12}$	150		165		180		195		210		225		240		260		300		335		375		450	
$\frac{WL}{10}$	125		135		150		160		175		185		200		220		250		280		310		375	
$\frac{WL}{9}$	110		120		135		145		155		170		180		195		225		250		280		335	
$\frac{WL}{8}$	100		110		120		130		140		150		160		175		200		225		250		300	
Span	T.	R.	T.	R.	T.	R.	T.	R.	T.	R.	T.	R.	T.	R.	T.	R.	T.	R.	T.	R.	T.	R.	T.	R.
6' 0"	...	...	...	...	...	...	...	...	3	.19	3	.20	3	.22	3	.26	3	.29	3	.32	3	.39	3	.39
7' 0"	...	...	3	.19	3	.21	3	.23	3	.24	3	.26	3	.28	3	.32	3	.35	3	.38	3	.44	4	.42
8' 0"	3	.23	3	.25	3	.27	3	.30	3	.32	3	.34	3	.37	3	.40	3	.46	4	.41	4	.46	4	.55
9' 0"	3	.29	3	.32	3	.35	3	.37	3	.39	3	.41	3	.43	4	.40	4	.46	4	.52	4	.58	5	.57
10' 0"	3	.36	3	.39	3	.43	3	.46	4	.40	4	.43	4	.46	4	.50	4	.57	5	.53	5	.59	5	.71
11' 0"	3	.43	3	.47	4	.42	4	.45	4	.48	4	.52	4	.55	4	.61	5	.57	5	.64	5	.72	6	.73
12' 0"	4	.41	4	.45	4	.49	4	.53	4	.58	5	.51	5	.55	5	.60	5	.68	6	.65	6	.72	7	.78
13' 0"	4	.48	4	.53	4	.58	5	.52	5	.56	5	.60	5	.64	5	.70	6	.68	6	.77	7	.76	8	.80
14' 0"	4	.56	5	.51	5	.56	5	.60	5	.65	5	.69	6	.63	6	.69	6	.79	7	.79	8	.78	9	.85
15' 0"	5	.53	5	.58	5	.64	5	.69	6	.63	6	.68	6	.72	6	.79	7	.81	8	.81	8	.89	10	.88
16' 0"	5	.60	5	.68	5	.72	6	.67	6	.72	6	.77	7	.74	7	.81	8	.81	9	.84	9	.93	12	.83
17' 0"	5	.68	6	.64	6	.70	6	.75	6	.81	7	.78	7	.83	8	.80	9	.84	10	.84	10	.94	12	.93
18' 0"	6	.65	6	.72	6	.78	7	.76	7	.82	8	.77	8	.82	8	.90	9	.94	10	.95	12	.87	15	.83
19' 0"	6	.73	6	.80	7	.78	7	.84	8	.80	8	.86	9	.84	9	.92	10	.95	12	.87	12	.97	15	.93
20' 0"	6	.81	7	.79	8	.76	8	.82	8	.89	9	.87	9	.93	10	.91	12	.86	12	.97	15	.86	15	1.03
21' 0"	7	.79	8	.77	8	.85	8	.91	9	.89	10	.86	10	.92	12	.83	12	.95	15	.85	15	.94	...	...
22' 0"	8	.77	8	.84	9	.84	9	.91	10	.88	10	.94	12	.83	12	.91	15	.83	15	.93	15	1.04	...	...
23' 0"	8	.84	9	.84	9	.91	10	.89	10	.96	12	.85	12	.91	12	.99	15	.90	15	1.02	...	...	...	...
24' 0"	9	.84	9	.92	10	.90	12	.80	12	.87	12	.93	12	.99	15	.87	15	.99	...	...	...	...	...	...
25' 0"	9	.91	10	.89	12	.81	12	.87	12	.94	12	1.00	15	.86	15	.94	15	1.07	...	...	...	...	...	...

Basement and Garage Floors Basement, barn, garage and feeding floors may be poured on a base of three or four-inch partition tile laid with staggered joints in alternate rows and bedded on a cushion of sand or cinders. This type of construction provides a dead air space under the concrete floor, is warmer and eliminates dampness.

Backup In backing up masonry veneer walls the methods used are the same as used with standard backup tile, the hollow tile

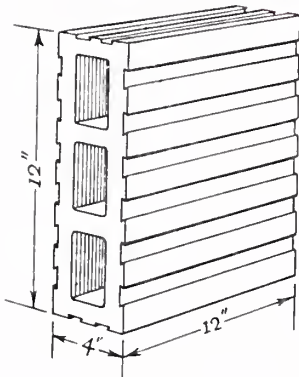
being tied to the veneer by metal ties or header courses in the masonry. As the load bearing strength of partition tile is less than that of standard backup tile this type of construction is not recommended for backing bearing walls.

Other Uses The use of standard partition tile for furring, girder protection, fillers and column covering is described with our split furring, girder protection material and column covering, respectively.

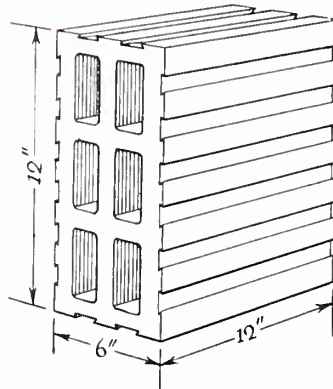




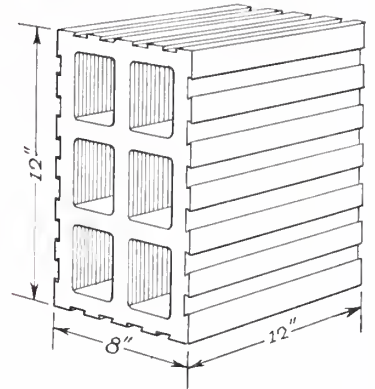
LOAD BEARING TILE



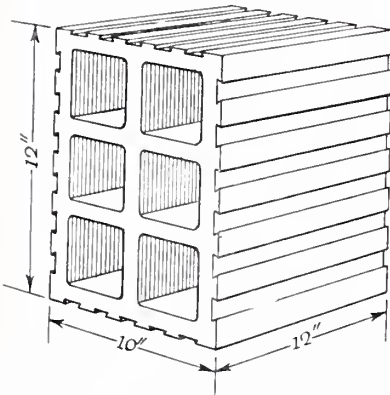
4"x12"x12"
3 cell
Wt. Approx. 20 lbs.



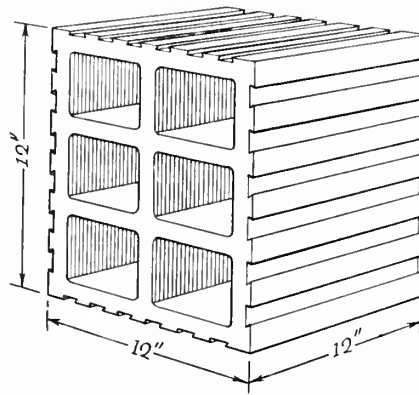
6"x12"x12"
6 cell
Wt. Approx. 30 lbs.



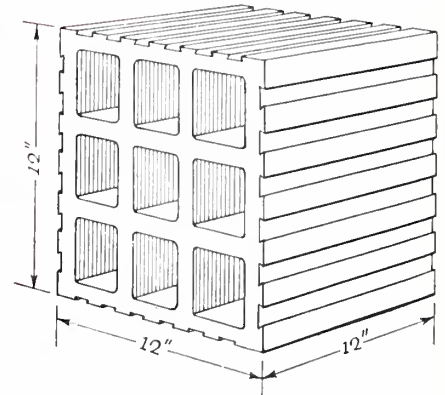
8"x12"x12"
6 cell
Wt. Approx. 36 lbs.



10"x12"x12"
6 cell
Wt. Approx. 42 lbs.



12"x12"x12"
6 cell
Wt. Approx. 48 lbs.



12"x12"x12"
9 cell
Wt. Approx. 52 lbs.

Uses

Load bearing tile are scored for plaster or stucco on four sides and may be laid with cells either horizontal or vertical.

Standard load bearing tile are used in all types of load bearing walls. When used for exterior walls they are generally finished outside with a brick veneer or stucco and plastered inside if a finished inside wall is desired. They are also used for interior load bearing walls, being plastered on one or both sides or unplastered, as specifications require.

Other uses are: Backing up solid masonry walls in skeleton frame structures.

In the construction of piers and columns.

In foundation walls for small or moderate sized dwellings, garages, stores, etc.

Load bearing tile are also used for any purpose for which standard partition tile can be used with a resultant greater strength, although consideration should be given to the increased weight.

Compression Test Load Bearing Tile.

Conducted by Pittsburgh Testing Laboratory
Pittsburgh, Pa.

Laboratory No. 49557

Date Aug. 25, 1922

Cells Vertical Under Load.

Type—12"x12"x12", 6 cell

Test Piece	Cross Sectional Area, Square Inches	Crushing Load, Pounds	Crushing Strength, Pounds
1.	141.50	228,100	1611
2.	142.80	215,000	1506
3.	140.20	209,800	1494

Type—8"x12"x12", 6 cell

1.	97.20	208,950	2149
2.	95.20	212,260	2229
3.	96.00	240,400	2504



LOAD BEARING TILE

Load Bearing Walls

Five important factors enter into the growing popularity of hollow tile for use in load bearing walls. Briefly they are:

- Strength, with resultant load carrying capacity.
- Lightness, saving in material costs.
- Ease of erection, economy in erection costs.
- Permanence, low depreciation.
- Fire resistance, low insurance rates.

Methods of Laying Load bearing walls may be constructed with cells laid either horizontal or vertical. Little can be said of the advantages of either method over the other as the greater volume and bed of mortar obtained when tile are laid with cells horizontal offsets the greater crushing strength developed by the vertical method of laying. The strength of the finished wall when properly laid is about the same for either method of laying and the weakest link in a wall of load bearing tile is the mortar joints. A hollow tile wall properly laid with good cement and lime mortar will develop from 60% to 75% of the strength of the tile, allowing a good factor of safety for all types of structures.

Bonding Any method of bonding which provides suitable strength will meet the requirements for stucco or veneer backup walls. The illustrations (Fig. 2 and Fig. 3) show the methods of bonding the eight-inch and 12-inch load bearing wall with cells vertical.

In the eight-inch wall a 4"-8" break in joints is obtained without special material. In the twelve-inch wall, a standard 6"x12"x12" load bearing tile serves as a corner block producing a six-inch running bond.

The four-inch tile provides a 4"-8" break in joints, the six-inch tile a running bond of six inches, while with the ten-inch tile it is only possible to secure a 2"-10" break in joints without the use of special material.

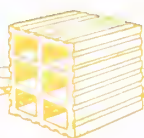
When walls are constructed of hollow tile laid with the cells horizontal the break in joints can be equalized by the use of "pieces" which are furnished. If the tile are laid with cells horizontal it is necessary to seal the cells of the corner tile. This is done by setting the tile intended for corner blocks on end on a board or other smooth surface and filling the cells to a depth of four or five inches with concrete or cement mortar which will harden over night. This method is also used for sealing the ends around openings.

Lintels There are several types of approved lintel construction for load bearing walls. The simplest of these are the structural angle or "L" iron illustrated in Fig. 4.

The reinforced concrete and tile lintel illustrated in Fig. 5, is constructed by setting the tile of the proper size on a board or other smooth surface and building upon it with other tile of the same size to the proper height to cover the opening and allow ample bearing on each side. The required amount of reinforcing steel is then placed inside the cells which are to rest at the bottom of the lintel and all cells are filled with concrete. When the concrete has set the lintels can be set in place as a unit. If the lintel is long it is always advisable to use a light reinforcing rod in one of the top cells to provide for tension while the lintel is being handled.

Practically the same result can be obtained by laying the tile with cells horizontal on a wood support which has been constructed at the top of the opening, inserting the reinforcing rod in the lower cells and filling the cells with concrete through holes which have previously been chipped through the top shell and intermediate webs at the joints.

The carrying capacity of these reinforced concrete and tile lintels is equal to the carrying capacity of reinforced concrete lintels having the same cross sectional dimensions as the tile used and an equal area of reinforcing steel.



LOAD BEARING TILE Load Bearing Walls

Another very practical lintel is built from standard flat arch material, the cells of the key being sealed with concrete or cement mortar.

For very long openings, such as display windows, garage doors, etc., it is advisable to use structural steel lintels protected with standard girder covering material which also provides a surface for the stucco and plaster finish.

Jambs Jamb construction in connection with load bearing walls is shown in connection with Jamb Blocks illustrated on the following pages.

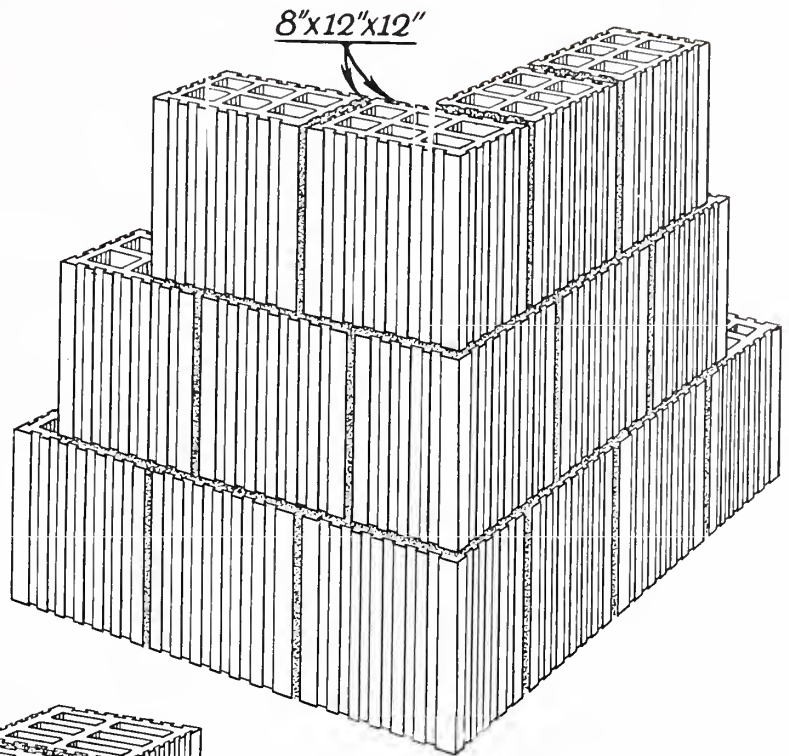


Fig. 2—Showing method of laying eight-inch load bearing wall of 8"x12"x12" load bearing tile laid with cells vertical. 8"x12"x12" tile as corner block provides 8"-4" break in joints.

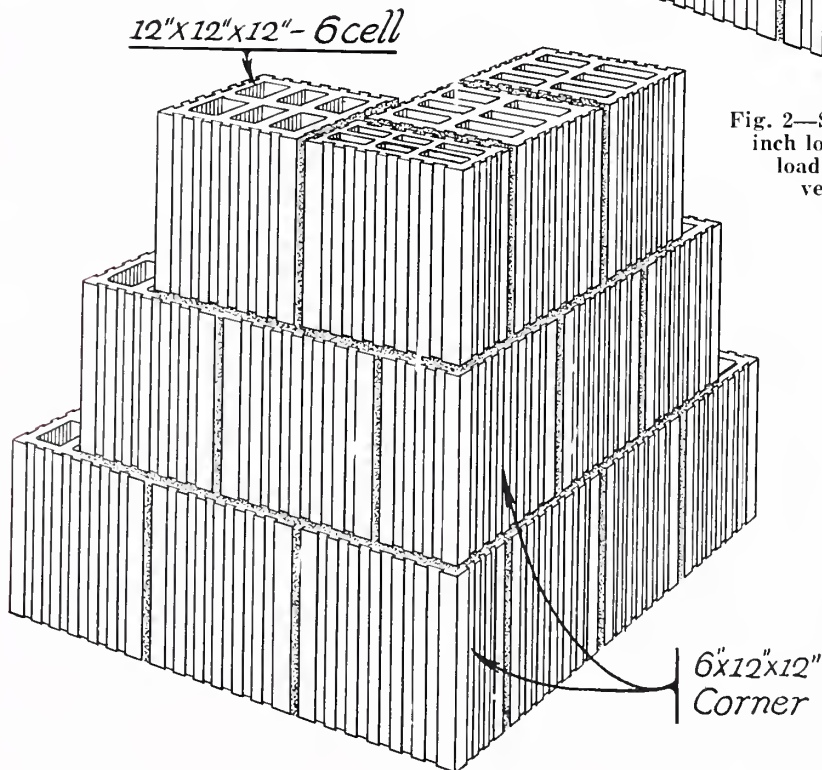


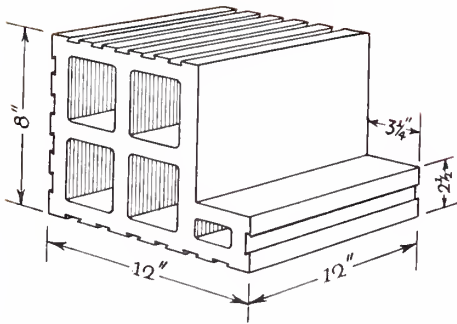
Fig. 3—Section of twelve-inch load bearing wall constructed of 12"x12"x12" load bearing tile, laid with cells vertical. 6"x12"x12" tile used as end block produces six-inch running bond.

Load Bearing Tile In Backing Up Masonry Walls

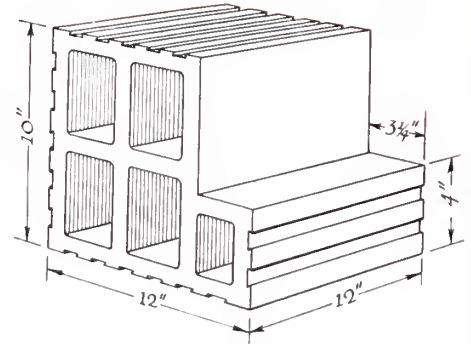
The methods of using load bearing tile for backing up masonry veneer walls are the same as those in practice where our standard backup is used, the hollow tile being tied to the veneer with either metal ties or a solid masonry bond.



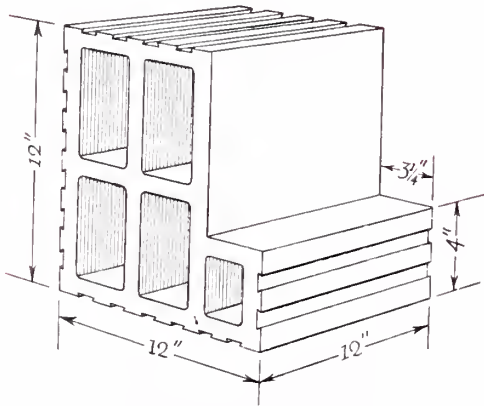
LOAD BEARING TILE Jamb Blocks



8"x12"x12" Full Jamb
5 cell



10"x12"x12" Full Jamb
5 cell

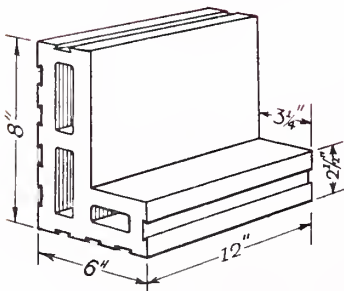


12"x12"x12" Full Jamb
5 cell

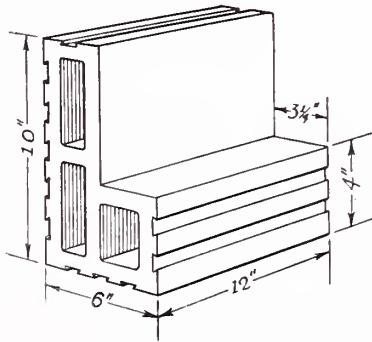
Uses

Jamb Blocks are designed for use in connection with walls of load bearing tile laid with cells either horizontal or vertical, being cut back to lay up around standard built up wood jambs for counterbalanced sash. Half jamb blocks are provided to allow for a full six-inch running bond. All jamb blocks are scored for plaster or stucco where finish is to be received.

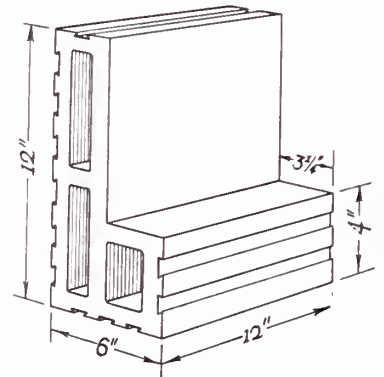
Half Jamb Blocks



8"x6"x12" Half Jamb
3 cell



10"x6"x12" Half Jamb
3 cell



12"x6"x12" Half Jamb
3 cell



LOAD BEARING TILE Jamb Construction

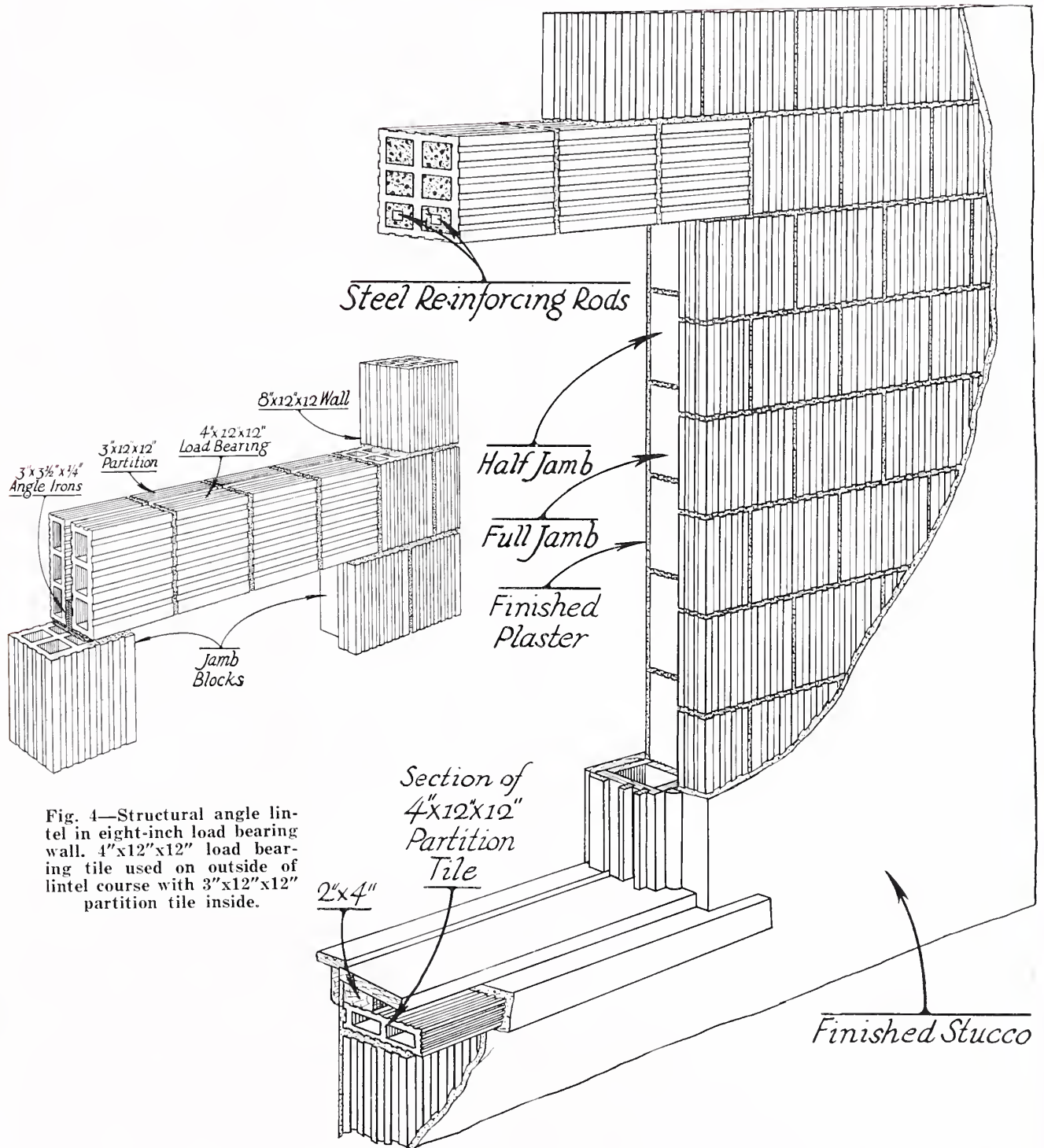
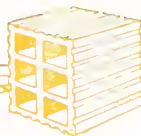


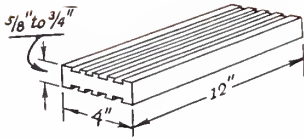
Fig. 4—Structural angle lintel in eight-inch load bearing wall. 4"x12"x12" load bearing tile used on outside of lintel course with 3"x12"x12" partition tile inside.

Fig. 5—Jamb constructed of standard Jamb and Half-Jamb material with reinforced concrete and hollow tile lintel and tile sill.

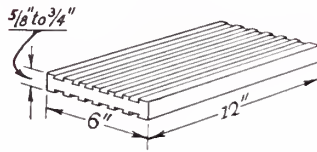




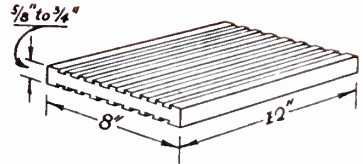
LOAD BEARING TILE Tile Slabs



4"x12"
Wt. Approx. 4 lbs.



6"x12"
Wt. Approx. 6 lbs.



8"x12"
Wt. Approx. 8 lbs.

Uses

Tile slabs are used as bearing plates (See Fig. 6) under joists in load bearing walls. They also serve as bearing plates in connection with the use of combination floors resting on load bearing walls, preventing the concrete from running into the cells of the wall tile when the tile are laid with cells vertical.

In combination floors, elsewhere described, four-inch tile slabs are used between the hollow tile fillers to provide a solid tile ceiling. In this process they also aid materially in the accurate spacing of the fillers.

Wherever it is necessary to space out fillers, as in Fig. 6, tile slabs form the most practical material.

Load Bearing Wall Construction

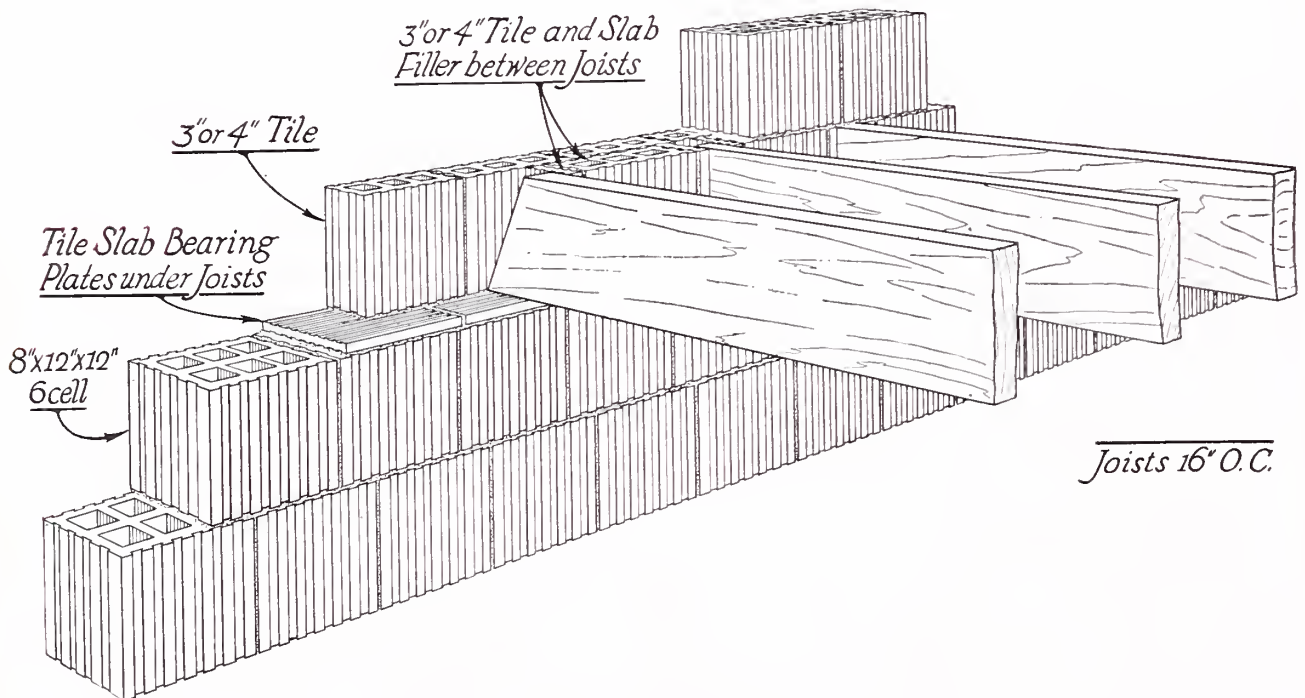


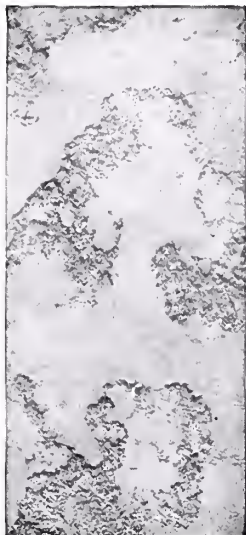
Fig. 6—Illustrating the use of tile slabs as bearing plates for joists in load bearing wall and filling between joists, with tile and slab fillers.



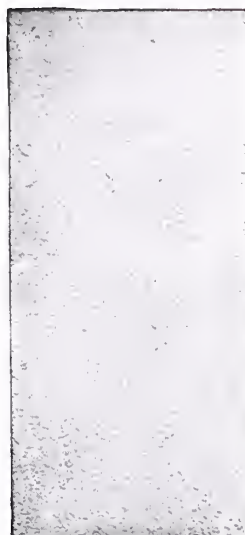
STUCCO



English Cottage



Italian



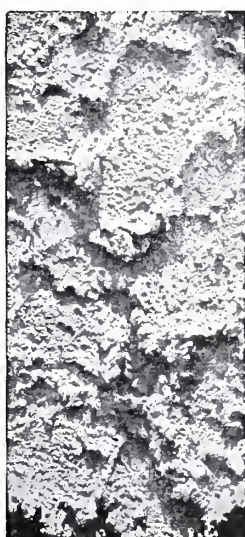
Colonial



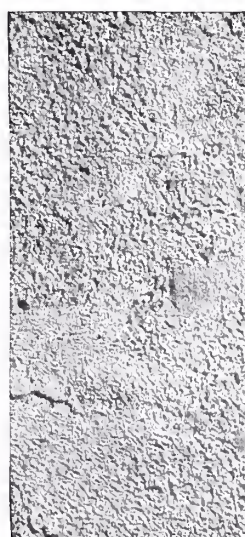
Gothic



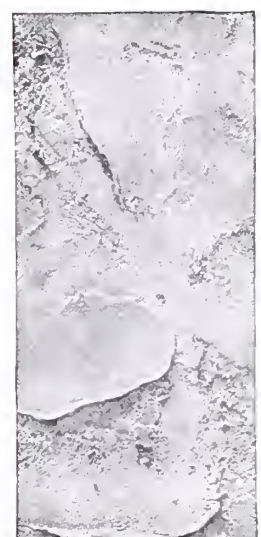
Italian Cottage



Greek



Modern American



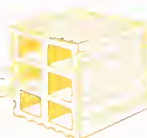
English

The following simple rules, if carefully followed, will facilitate the application of cement stucco finish.

Mixing Mortar should be mixed dry. The sand should be spread evenly over the bottom of the box and the required amount of cement placed on top of it. The sand and cement should be thoroughly mixed until the mixture is of a uniform color. Two-thirds of the water required should then be added and the

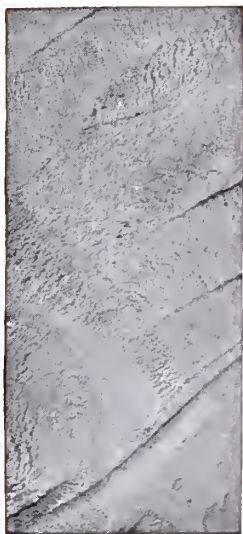
whole mixture worked thoroughly, adding water to the dry spots as required, until the proper consistency is obtained. Too thin a mixture is better than too thick, although the addition of too much water makes the mortar difficult to handle and retards drying, especially in damp or cold weather.

When dry hydrated lime is used in the cement stucco it should be added with the cement and worked thoroughly into the mixture before adding water.





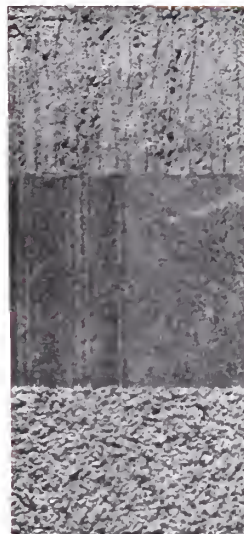
STUCCO



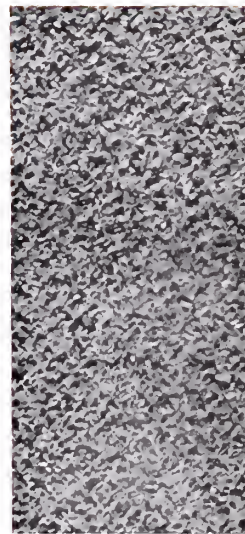
French



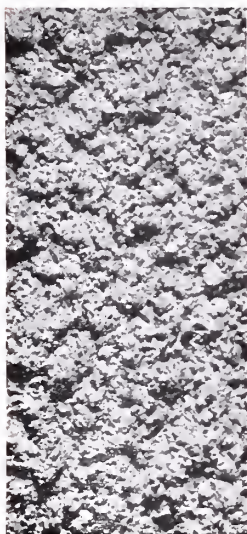
California



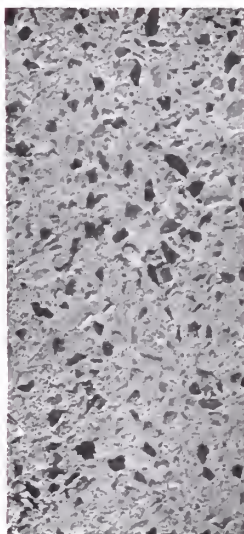
(1) Scratch (2) Base
(3) Finish



Sand Sprayed



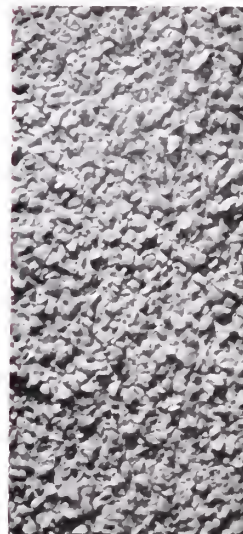
Rough Cast



Exposed Aggregate



Pebble Dash (Coarse)



Pebble Dash (Medium)

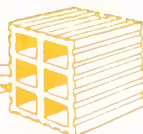
Illustrations by the courtesy of The Portland Cement Association and The Sandusky Portland Cement Co.

Application The mortar should be applied in a continuous coat and the edges must not be allowed to dry. When it has stiffened sufficiently it may be floated. The mortar should not be "floated" or troweled too much as this brings the cement to the surface, causing cracks.

The first coat should be brought to an even surface, using a straight edge. Before applying the second coat, the surface should be cross-

scratched to provide a mechanical bond for the second coat.

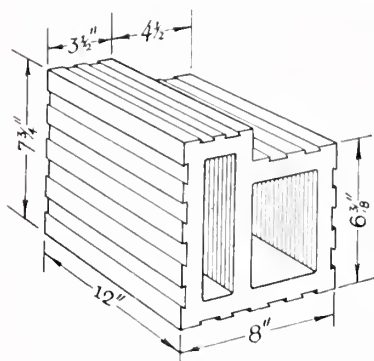
Finishes The illustrations show various types of texture and pebble finishes obtainable with stucco. Any of these finishes may be reproduced by competent plasterers and the various manufacturers of cement and stucco compositions have prepared valuable data for the assistance of the architect and workman.





PERFECTION BLOCK

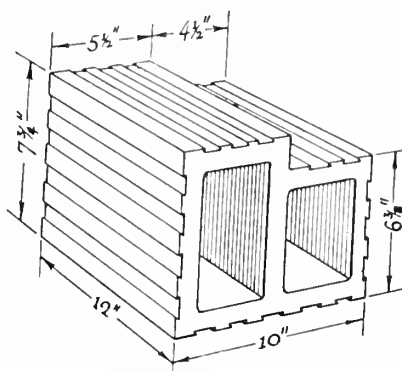
(Patented)



8" Perfection Block
8"x7 3/4"x12"

2 cell

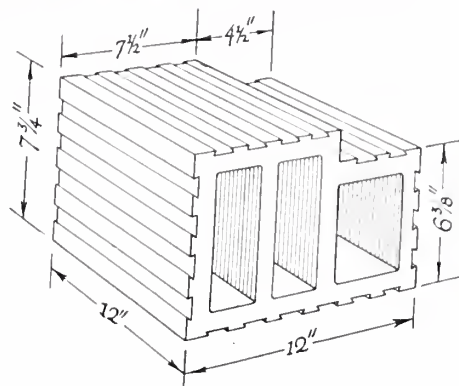
Wt. Approx. 26 lbs.
Full inch web and shell



10" Perfection Block
10"x7 3/4"x12"

2 cell

Wt. Approx. 32 lbs.
Full inch web and shell



12" Perfection Block
12"x7 3/4"x12"

3 cell

Wt. Approx. 39 lbs.
Full inch web and shell

Uses

PERFECTION BLOCK, for which we hold the patents and exclusive manufacturing rights, were designed by our engineers to meet the insistent demand for a strong, easily laid, fire-proof backup material for brick veneer exterior walls of large skeleton frame structures. They

are one of the very few materials ever developed for the fireproof backing with header bond of twelve-inch, fourteen-inch or sixteen-inch face brick veneer walls without the use of any other backup material of other sizes and shapes. The economies of handling and laying are therefore readily discernable.

Method of Using

PERFECTION BLOCK are laid in the same manner as ordinary backup tile, reversing every other course (See Figs. 7, 8 and 9), and the header courses of face brick which fit into the offset at every sixth course provide a solid masonry bond between backing and veneer, without the use of any other form of tie.

All webs and shells are made full inch thick to comply with even the most stringent building laws. When this feature is considered with

the fact that the hard burned fire clay used in their manufacture has a much higher crushing point than the soft burned shale generally used, it is easily seen that either as a unit or in the completed wall they are without a peer as regards load bearing capacity or factor of safety.

The tests conducted by the Testing Laboratory of Columbia University, New York City, and reproduced on the last page of this section, show the load bearing strength of the various sizes.



PERFECTION BLOCK

(Patented)

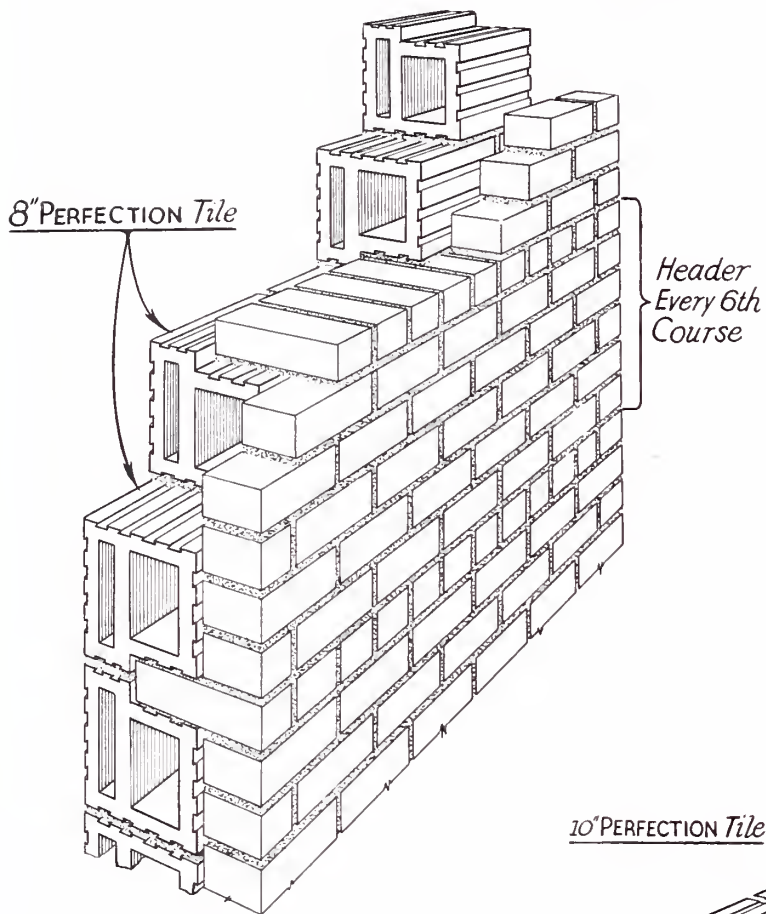


Fig. 7—Section of twelve-inch load bearing wall with brick veneer backed with eight-inch PERFECTION BLOCK, showing method of bonding

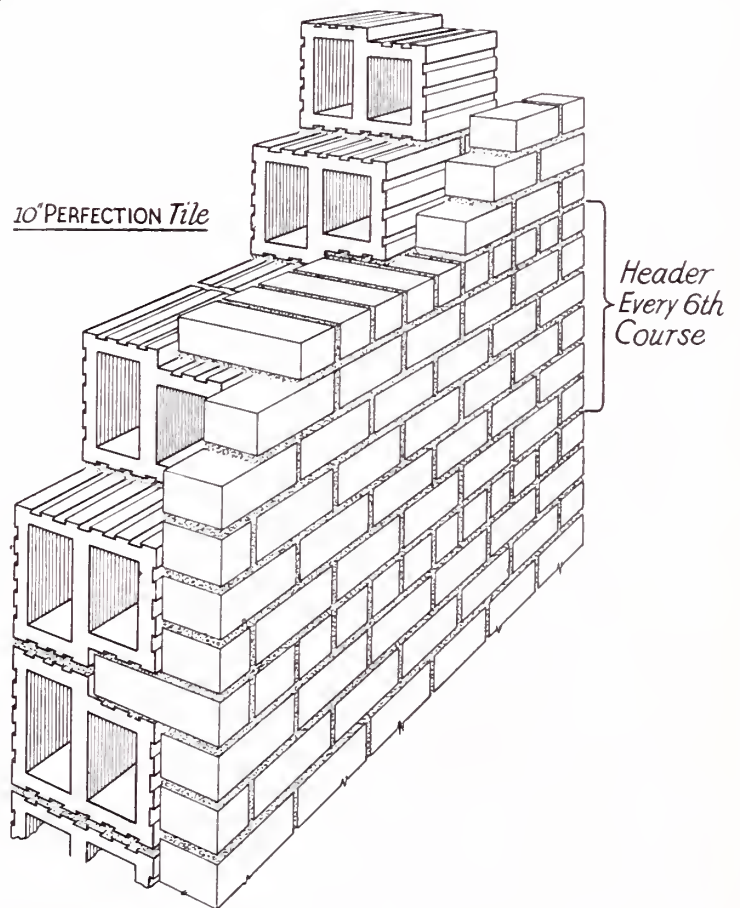


Fig. 8—Section of fourteen-inch load bearing wall with brick veneer, backed with ten-inch PERFECTION BLOCK.

PERFECTION BLOCK

(Patented)

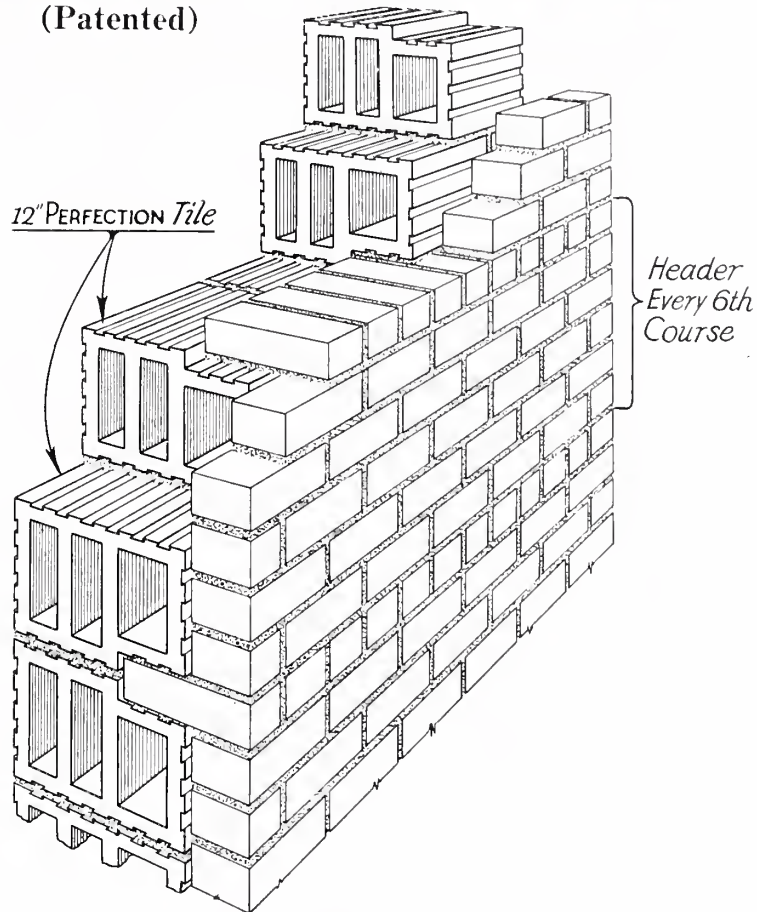


Fig. 9—Section of sixteen-inch load bearing wall with brick veneer backed with twelve-inch PERFECTION BLOCK.

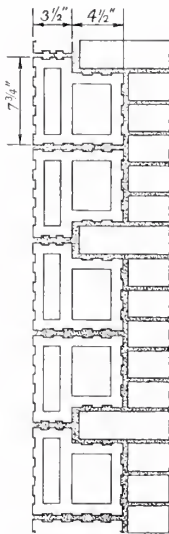


Fig. 10—Cross section of twelve-inch PERFECTION backed brick veneer wall showing method of bonding and dimensions.

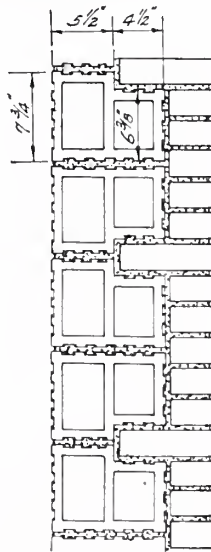


Fig. 11—Cross section of fourteen-inch PERFECTION backed brick veneer wall.

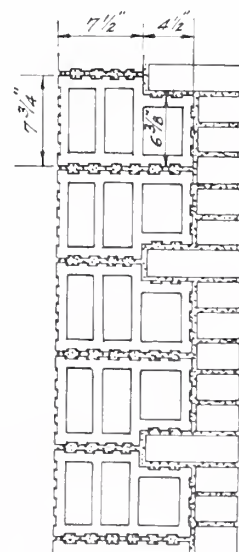


Fig. 12—Cross section of sixteen-inch PERFECTION backed brick veneer wall.



PERFECTION BLOCK

(Patented)

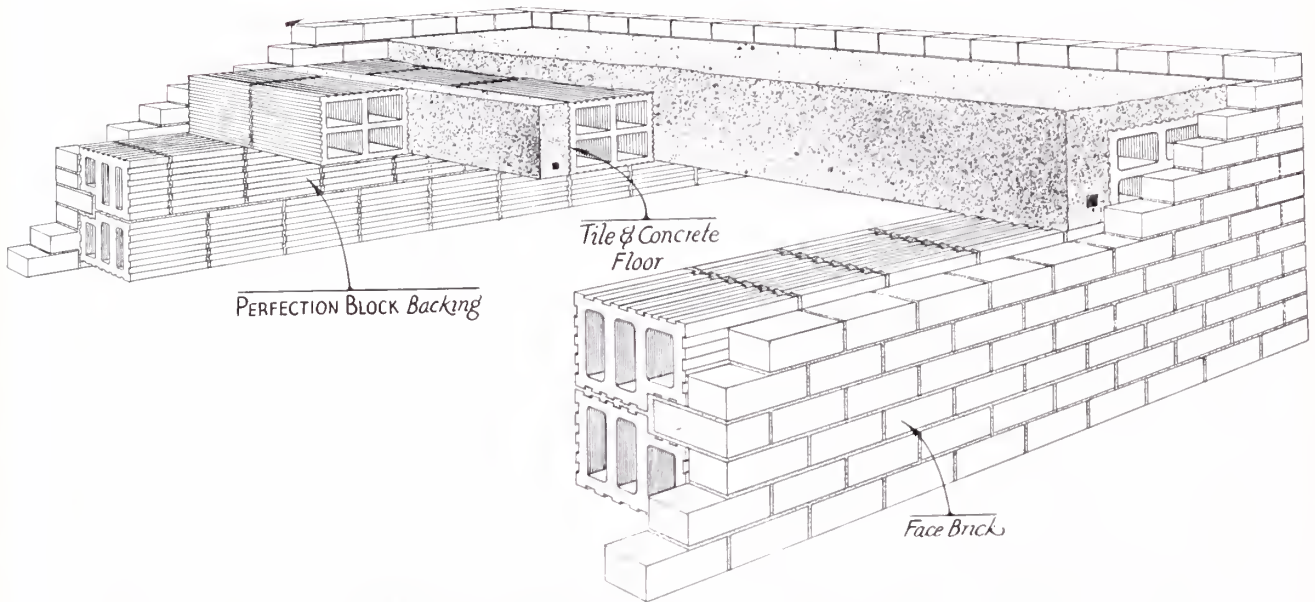


Fig. 13—Illustrating PERFECTION BLOCK backup carrying combination reinforced concrete and hollow tile floor.

Report of Compression Tests

Testing Laboratories—Department of Civil Engineering
Columbia University, New York City
Cells Horizontal under Load

Type—Standard 8" PERFECTION Block

Test No.	Length, Inches	Width, Inches	Height, Inches	Gross Area, Sq. Inches	Maximum Load, Lbs.	Ultimate Strength, Lbs.
23208	12.00	7.80	7.70	93.7	287,130	3,065
23209	12.28	7.95	7.75	97.6	217,180	2,225
23210	12.10	7.90	7.78	95.6	169,800	1,775
23211	12.08	8.00	8.00	96.6	261,660	2,710
23212	12.05	7.98	8.00	96.3	179,260	1,860

Date, Nov. 3, 1923.

Type—Standard 10" PERFECTION Block

25070	11.90	9.95	8.00	118.5	191,030	1,610
25071	11.80	9.92	8.30	117.0	186,000	1,590
25072	12.00	9.82	8.10	117.8	164,950	1,400
25073	11.80	10.10	8.30	119.2	147,450	1,240
25074	11.94	10.10	8.20	120.5	226,670	1,880

Date, April 14, 1924.

Type—Standard 12" PERFECTION Block

25090	11.85	11.90	7.00	141.0	272,380	1,930
25091	11.90	11.90	7.10	141.7	207,000	1,460
25092	11.80	11.85	7.25	140.0	206,660	1,480
25093	11.96	11.75	7.00	140.5	272,510	1,940
25094	11.82	11.85	7.14	140.0	211,800	1,510

Date, April 14, 1924.

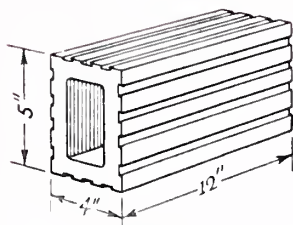
All specimens were bedded with neat Portland Cement for test.

The May, 1922 Building Code of New York City requires an ultimate strength of 300 pounds per square inch of gross area for Hollow Terra Cotta Building Block laid with the cells horizontal. It will be seen by reference to the test above the PERFECTION Block develop from four to six times the strength required by the most stringent building laws.

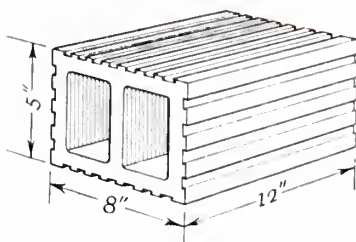
The deep scoring provides a firm mechanical bond between tile and mortar and also a plastering ground on the interior surface.



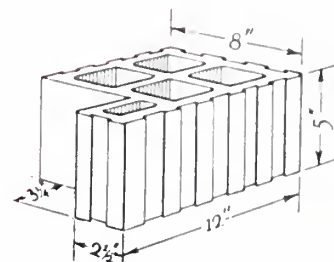
BACKUP TILE



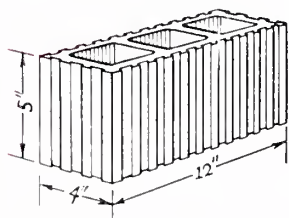
5"x4"x12"
1 cell
Wt. Approx. 9 lbs.



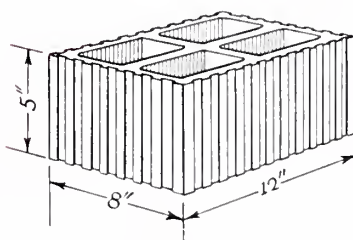
5"x8"x12"
2 cell
Wt. Approx. 16 lbs.



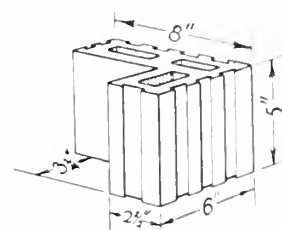
5"x8"x12" Jamb Block
5 cell



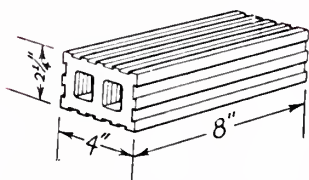
5"x4"x12" Corner Block
3 cell
Wt. Approx. 9 lbs.



5"x8"x12" Corner Block
4 cell
Wt. Approx. 16 lbs.

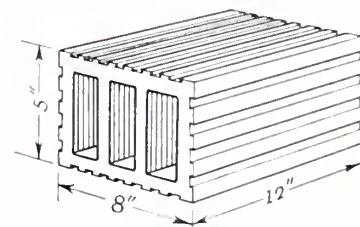


5"x8"x6" Half Jamb
3 cell



Hollow Brick
2 1/4"x4"x8"
2 cell
Wt. Approx. 3 1/2 lbs.

Unless otherwise specified, Backup Tile are furnished plain on one 5"x12" side.



5"x8"x12"
3 cell
Wt. Approx. 16 lbs.

Uses

Backup tile are ideal for all types of load bearing walls. They are equally adapted for masonry or stucco veneer backing.

Following more closely the dimensions of face brick, they produce a very strong bond when used in backing brick veneer walls.

With the seven shapes above illustrated it is possible to secure almost any desired bond.

Backup tile may also be used for spacing out four-inch, eight-inch and twelve-inch load bearing and partition walls to secure the proper height of openings, as fillers in various types of construction and for enclosing or curtain walls of skeleton frame structures.

The following tests illustrate the crushing strength developed by this type of material.

Compression Test—Backup Tile

Conducted by Pittsburgh Testing Laboratory
Pittsburgh, Pa.

Laboratory No. 49557 Date—Aug. 25, 1922.

Type—4"x5"x12" Cells Horizontal

Test Piece	Cross Sectional Area, Square Inches	Crushing Load, Pounds	Crushing Strength, Pounds
1	46.68	39,000	835
2.	47.60	50,000	1050
3.	47.60	38,650	812



BACKUP TILE Backup Tile Bearing Walls

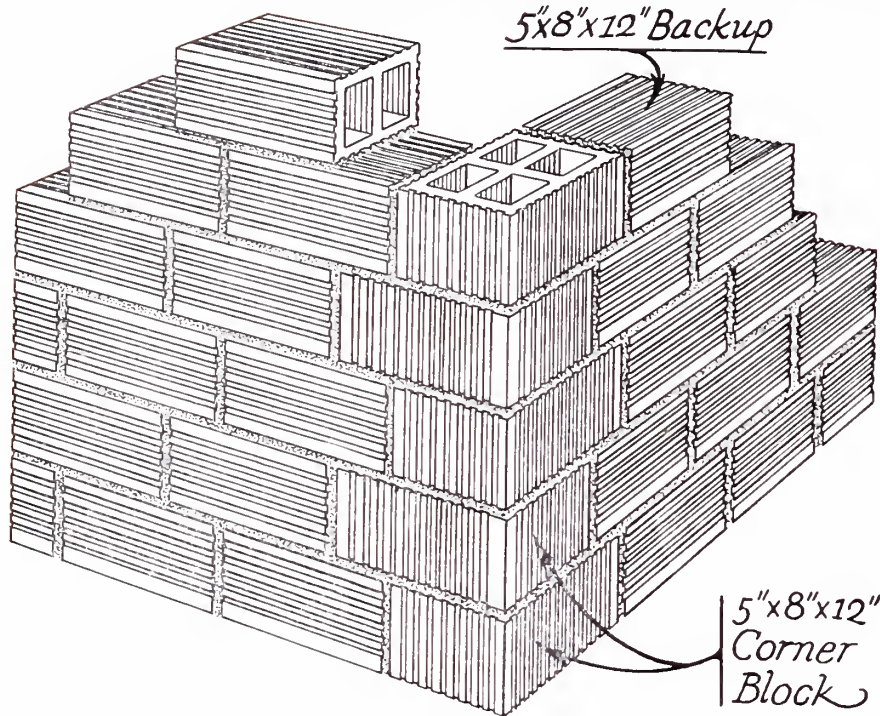


Fig. 14—Section of eight-inch load bearing wall constructed of standard 5"x8"x12" backup tile with 5"x8"x12" End Blocks, providing an 8"-4" break in joints.

Backup tile in all types of load bearing walls are laid with cells horizontal. Corner blocks in the 5"x8"x12" and 5"x4"x12" sizes eliminate the necessity of sealing the cells at corners and wall ends.

In certain sections of the country backup tile is used almost to the exclusion of other types in structures of small and medium size.

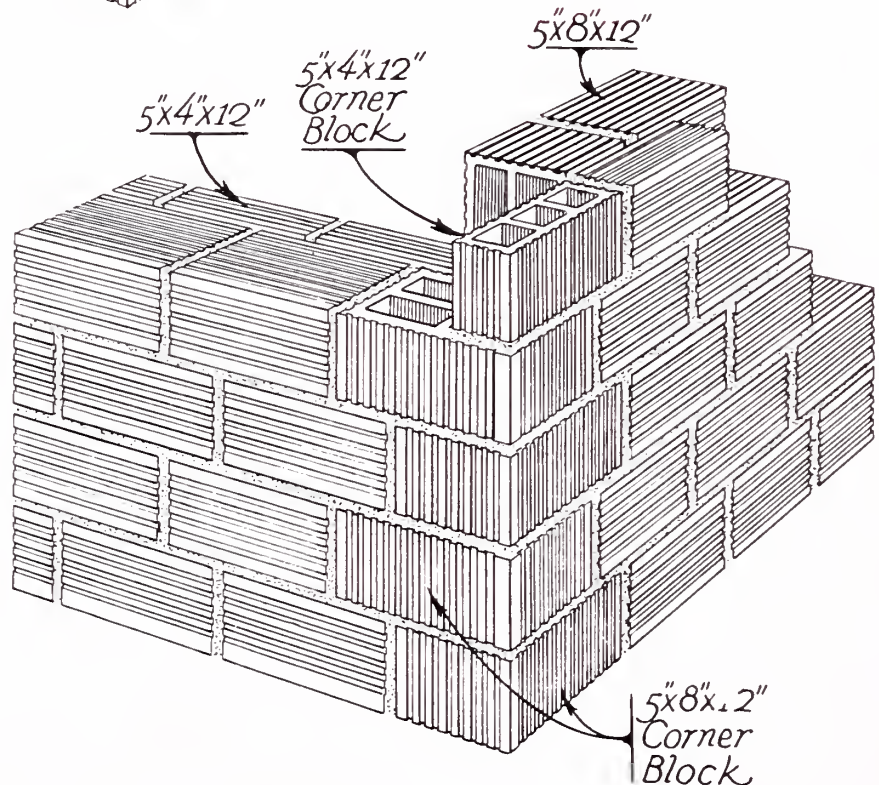


Fig. 15—Section of twelve-inch load bearing wall constructed of standard 5"x8"x12" and 5"x4"x12" backup tile, alternating four-inch and eight-inch tile outside. 5"x4"x12" end blocks produce an 8"-12" break in joints.





BACKUP TILE

Backup Tile Bearing Walls

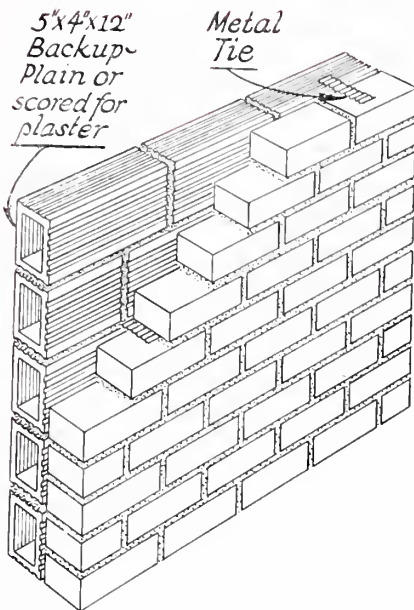


Fig. 16—Eight-inch brick veneer load bearing wall, using 5"x4"x12" backup material, bonded to veneer by metal ties.

Lintels For small openings in partition walls, the wall above the opening may be laid on the wood or metal bucks without the use of lintels. For larger openings in interior walls and for all exterior openings structural steel angles or "T"s are perhaps the most satisfactory. Reinforced concrete or flat arch lintels described in connection with our load bearing materials may also be employed, although their use calls for a certain amount of ingenuity in the matching of courses.

Other Uses

Curtain Walls The information given on this and the preceding pages also applies to the use of backup tile in the construction of curtain and enclosing walls in skeleton frame structures.

Fillers Tile fillers between wood or metal joists should be used in all types of hollow tile construction to produce an all-tile wall. Backup tile is ideal for this purpose. The use of "pieces" permits any desired spacing of joists, while the three sizes can be used in combination to accommodate joists of any height.

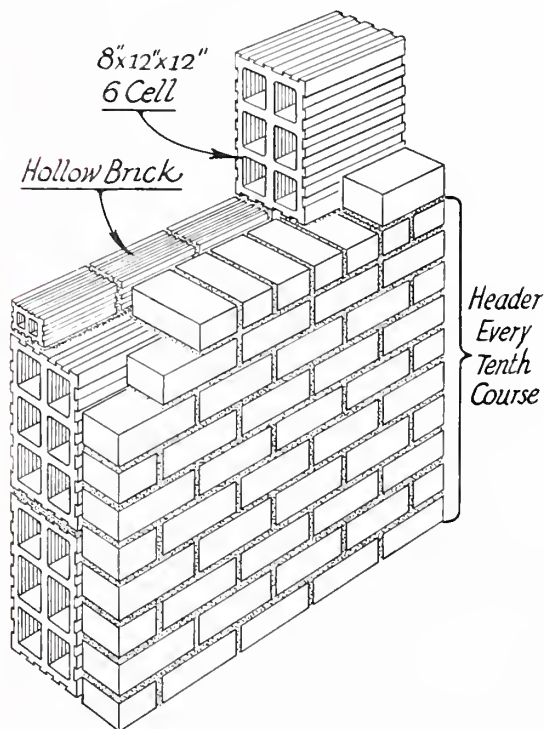


Fig. 17—Twelve-inch brick veneer load bearing wall, illustrating use of 8"x12"x12" load bearing tile, as backup with hollow brick to provide header bond

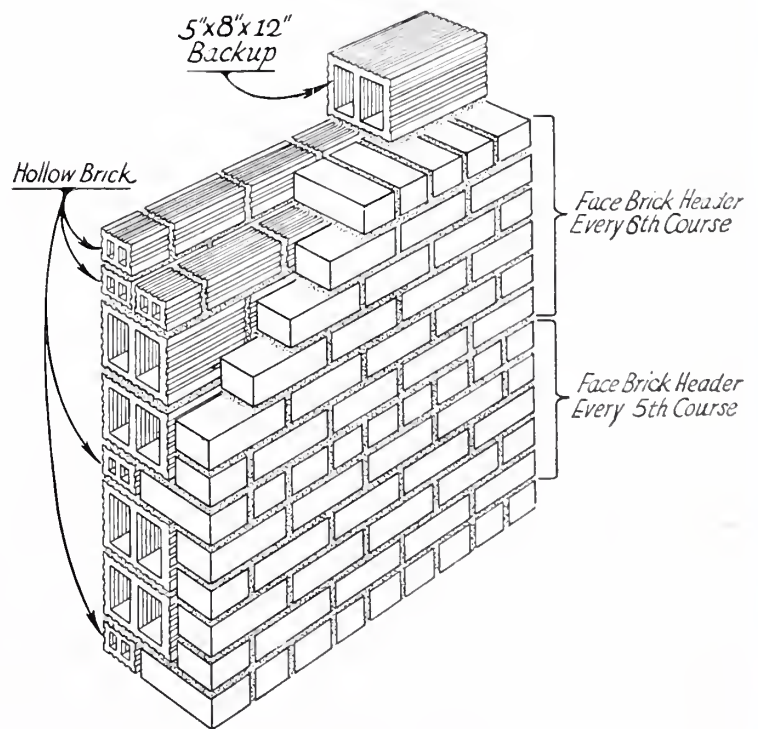


Fig. 18—Twelve-inch brick veneer load bearing wall, using 5"x8"x12" backup material as backing and hollow brick to provide header bond.

BACKUP TILE

Backup Tile Bearing Walls

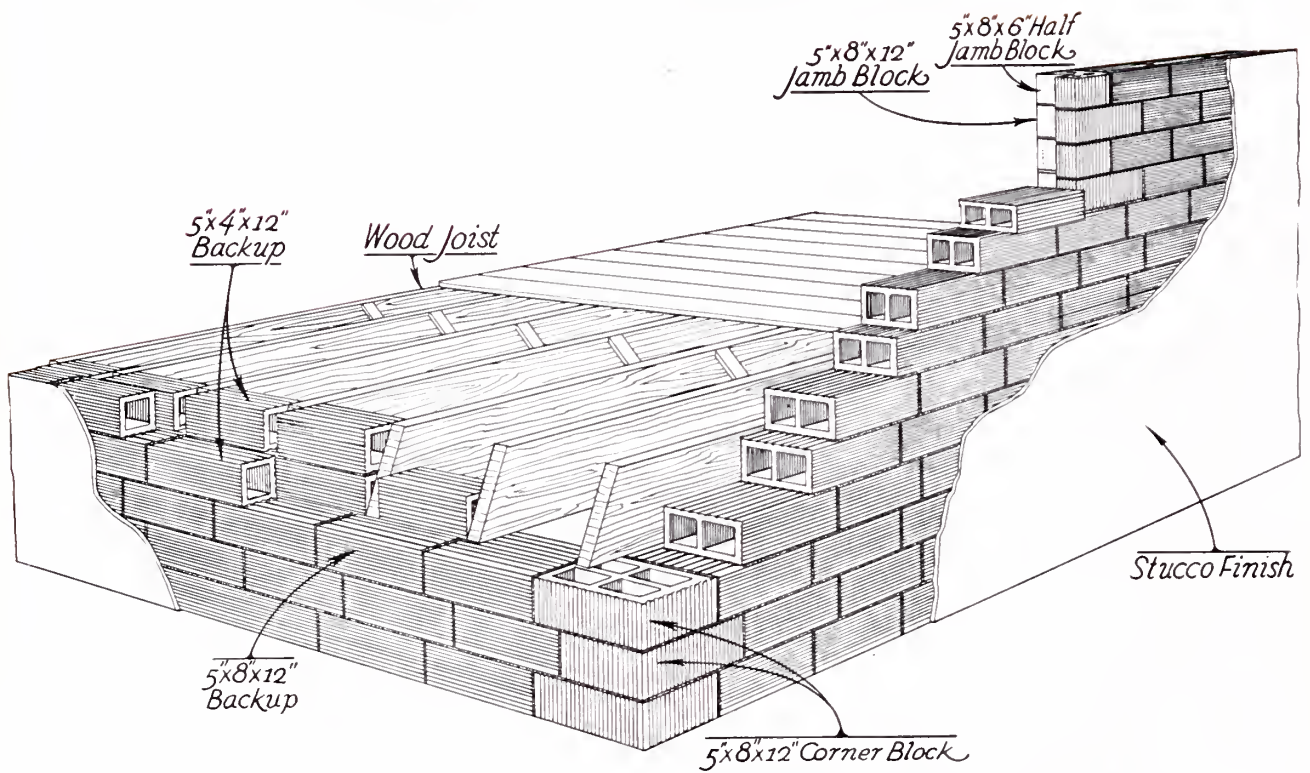
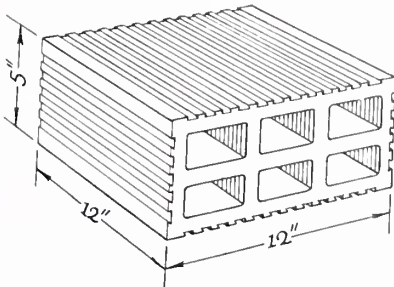


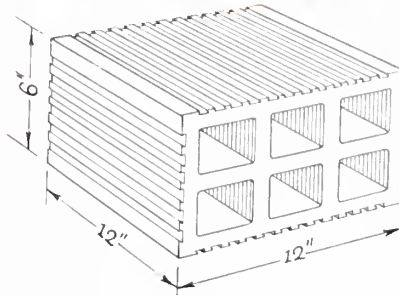
Fig. 19—Section of eight-inch load bearing wall, constructed of backup material, showing method of constructing jambs and joist pockets.



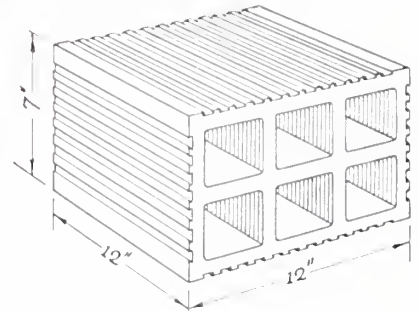
FLOOR TILE



5"x12"x12"
6 cell
Wt. Approx. 26 lbs.



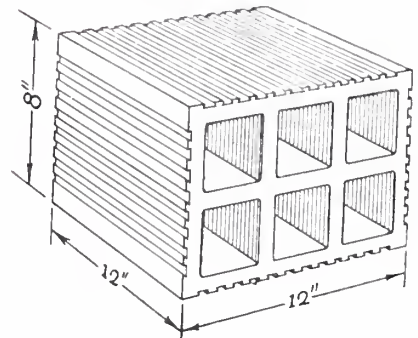
6"x12"x12"
6 cell
Wt. Approx. 30 lbs.



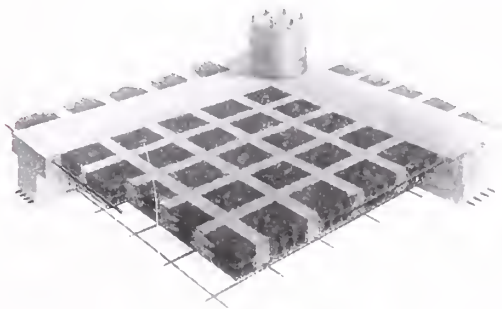
7"x12"x12"
6 cell
Wt. Approx. 31 lbs.

Schuster Hollow Tile Floors

Introduction Schuster Hollow Tile Floor Construction, because of its economy, adapts itself to practically all types of buildings and especially to structures such as office buildings, hotels, apartments, schools, hospitals and garages. It has been approved by practically all building departments and is being used by architects and engineers in Cleveland, Detroit, Buffalo, New York City, Baltimore, Washington, D. C., Atlanta, Indianapolis and many other cities. Many tests have been made by different cities and all have shown a greater factor of safety than required by conservative practice.



8"x12"x12"
6 cell
Wt. Approx. 32 lbs.



A Completed Floor Slab Ready to Receive
Finish Floor.

Description Schuster Hollow Tile Floors are a combination of **Hollow Tile** and **Concrete** reinforced in two directions and supported on four sides. The tile are special 12"x12" fire clay blocks of depth from four to twelve inches.

The tile is bonded to the concrete by the concrete forced into the open cells of the tile. The tile, therefore, is an integral part of the slab and resists shearing and compressive stresses. A thin light slab without concrete on top of the tile is thus obtained.

Each concrete joist between the rows of tile in each direction is reinforced with a straight

bar resisting positive moment and where continuity exists with a short straight bar over the supports resisting negative moment.

Load Tests The design of Schuster Hollow Tile Floors is based entirely on many tests. The most extensive of these tests was made by the Bureau of Standards, Washington, D. C., on a slab at Waynesburg, Ohio. The results of these tests are reported in Bureau of Standards Bulletin No. 220 and can be obtained upon request.

The following is a brief summary of some of the test results:

Size of panel—16' 0"x16' 0".

Design load—156 lbs. per sq. ft.

Superimposed test load—1400 lbs. per sq. ft.

Deflection obtained at twice the design load—.02 inch.

Size of panel—16' 0"x22' 0".

Design load—78 lbs. per sq. ft.

Superimposed test load—920 lbs. per sq. ft.

Deflection obtained at twice the design load—.09 inch.

Size of panel—16' 0"x19' 3".

Design load—107 lbs. per sq. ft.

Superimposed test load—1180 lbs. per sq. ft.

Deflection obtained at twice the design load—.10 inch.

The above superimposed loads, although approximately ten times the design load, remained on the slab over four years without causing collapse.





FLOOR TILE Schuster Hollow Tile Floors



Test Slab Loaded to 1100 Pounds per Square Foot. This is nine times Design Load of Slab.

Structural Features and Economy

Small dead loads permit the use of small beams, columns and footings. This effects a saving in concrete and reinforcement in these members as compared with other types of construction.

Tile used in shear and compression provides sufficient shearing area at the ends of each joist and eliminates the top concrete required by other floor systems as compressive area to develop the reinforcement. The tile is not a mere filler adding useless dead weight but is a structural member of the slab.

Load distribution equal to that obtained with flat slab construction is secured. Heavy concentrated loads distribute themselves over two or more joists in each direction. This means that substantially there is no such thing as a concentrated load with Schuster Hollow Tile floors.

Slab thickness from three to seven inches less in depth than that required by a one-way type of construction permits a total saving often amounting to an entire story height of the building. This means a material saving in masonry, pipes, conduits, stairs, etc.

Openings in the slab are easily handled. In many cases special framing is unnecessary.

Plaster applied directly on the tile requires two coats, whereas plaster on mesh requires three coats. If an all-tile ceiling is desired, soffit tile are used.

Top Finish Top finish, such as sleepers with wood floors, concrete with or without hardener, Terrazzo, Ceramic Tile, or any other finish applicable to any floor may be applied directly on the structural slab.

Conduits Conduits are placed economically in the slab where they are least detrimental to the strength of the construction; that is, near the bottom of the joist. However, should it be desired, they may be placed near the top of the slab by using a 2-inch thinner tile under the pipe.



Smythe Building,
Cleveland, Ohio.
W. S. Ferguson, Archt.,
G. Rutherford Co., Contractor.

Engineering Service

Complete design data for Schuster Hollow Tile Floors can be obtained upon request. To aid Architects and Engineers we are prepared to send an engineer to your office to prepare designs and estimate of cost.

For information on Schuster Hollow Tile Floors kindly address:

The Whitacre Engineering Co.,
706 Union Building,
Cleveland, Ohio.

Schuster Hollow Tile Floors licensed under Karl R. Schuster's Letters Patent of the United States, 1,134,164, dated April 6, 1915.





FLOOR TILE

Specifications For Schuster Hollow Tile Floor Construction

General All structural floor and roof slabs, unless otherwise shown on the plans, shall be Schuster Hollow Tile Floor construction. This construction is controlled by patents by THE WHITACRE ENGINEERING COMPANY, UNION BUILDING, CLEVELAND, OHIO, and contractor must obtain permission from them for their use.

Schuster Hollow Tile Floor construction shall consist of joists of reinforced concrete between rows of tiles in the two rectangular directions parallel to the sides of the panel. The tiles shall not be spaced closer than four inches so that the concrete may be poured around the reinforcement in a workmanlike manner. The ends of the tiles are to remain open and a small amount of concrete forced into the cells to firmly bond the tiles and the concrete.

The tiles are to be kept thoroughly wet during concreting.

When it becomes necessary to stop concreting before the completion of a panel, the cut-off must be made at the center of the panel and bulkheads must be provided at the centers of joists, beams and girders.

Hollow Tile The tiles are to be of the sizes and sections shown on the drawings and as manufactured by the Whitacre-Greer Fireproofing Company, Waynesburg, Ohio. They shall be well burned, free from cracks and scored on all exterior faces.

Reinforcement Reinforcement shall be of an approved type conforming in physical properties to the Manufacturers' Standard specifications and of such sizes and shapes as shown or called for on the drawings.

The steel bars shall be assembled in such a manner and so wired at their intersections that they will be held rigidly in place during concreting. They shall be raised $\frac{3}{4}$ inch above the forms and those extending in the short direction of a rectangular panel shall comprise the lower layer. All bars in the top of the slab shall be placed accurately so that they shall be protected by $\frac{3}{4}$ inch of concrete.

Concrete The slabs shall be of a thickness as shown on the plans and unless

otherwise shown or noted, the concrete joists shall be level with the top of the tiles.

Concrete shall be a uniform mixture of quaking consistency of one part of Portland cement of standard grade, two parts of clean sharp sand or screenings, and four parts of clean gravel, crushed rock or slag not larger than $\frac{3}{4}$ inch. The materials are subject to the approval of the engineer in charge. The proportions may be varied only with his approval. In no case will concrete with an excess of water, giving a slushy or soupy mix, be permitted for the slabs.

All concrete shall be machine mixed and shall be carried immediately after mixing to the point of construction and thoroughly spaded into forms, between all tiles and around reinforcement. Concrete in which the cement has attained its initial set shall not be used.

Wheeling over, or otherwise disturbing freshly laid concrete will not be permitted.

Any concrete work indicating that it has not been thoroughly mixed in the required proportions or that it has not been properly placed shall be dug out and replaced as directed by the architect or engineer or his authorized representative.

Concrete shall not be mixed nor placed in freezing weather unless special precautions are taken to heat the materials and to prevent the concrete from freezing after being placed. In

no case shall salt be used. Forms must not be removed in freezing weather until the architect or engineer is satisfied that the concrete is thoroughly set and not merely frozen.

Twenty-four hours after pouring the concrete and for several days thereafter all concrete work shall be thoroughly wetted in order that it shall be properly cured.

Forms Slab forms are to be of the closed type and shall be laid true to lines and levels. Any irregularity due to defective workmanship in this respect shall be corrected before the concrete is poured. All knotholes are to be properly filled or covered before the concrete is poured.



Liberty Bank Building,
Buffalo, N. Y.
A. C. Blossom, Archt.,
John Gill & Sons, Contractor.



Partial List of Buildings With Schuster Fireproof Floors

Store and Office Buildings

Location	Architects
Peoples Gas, El., Mason, City, Ia.	Ed B. Funstan Co.
Department Store, Racine, Wis.	F. L. Packard
Yuster Building, Columbus, Ohio	C. C. Hartman
Citizens Bk. & Tr., Rockhill, S. C.	Wyatt & Nolting
Arl'ton Bldg., Washington, D. C.	
Case Merc. Bldg., Canton, Ohio	W. S. Ferguson Co.
Med. Center Bldg., Cleveland	W. S. Ferguson Co.
Guenther Davis Bldg., Cleveland	W. S. Ferguson Co.
Siedman Bldg., Cleveland	A. C. Blossom
Liberty Bk. Bldg., Buffalo, N.Y.	A. W. Harris
Wilson Bldg., Cleveland	W. S. Ferguson Co.
2500 Euclid Bldg., Cleveland	A. C. Blossom
Wayne Ntl. Bk., Goldsboro, N.C.	C. C. Hartman
Fayetteville Bk., Fayetteville, N.C.	W. S. Ferguson Co.
Sixty-First & Euclid, Cleveland	Watson Engineering
Rogers Bldg., Cleveland	Woolworth Co.
Woolworth Bldg., Cleveland	Brown, Preston & Derrick
Stanley Bldg., Detroit, Mich.	

Schools

Lockport, Ill., Lockport, Ill.	A. C. Coyle
High School, Roselle Park, N. J.	Newman Collins
John Catlin School, Newark, N.J.	Dillon, McLellan & Beadle
	John J. Fagan
Public School 3, Hoboken, N.J.	
Lincoln H. S., Jersey City, N.J.	John T. Rowland
Public School 6, Jersey City, N.J.	John T. Rowland
Pub. School 23, Jersey City, N.J.	John T. Rowland
Atlantic City High, Atlantic City	Dept. of Bldg., B. of E.
Public School 38, Rochester, N.Y.	Dept. of Bldg., B. of E.
Public School 39, Rochester, N.Y.	Dept. of Bldg., B. of E.
Public School 40, Rochester, N.Y.	Dept. of Bldg., B. of E.
Immac. Concep., Rochester, N. Y.	Frank Frey
School of Hygiene, Baltimore, Md.	Obries & Lorenz
Lockport School, Lockport, N. Y.	F. J. Baldwin
St. Agnes High, Baltimore, Md.	F. J. Baldwin
Our Lady of Lourdes, Baltimore	Ed. L. Palmer
Roland Park, Baltimore, Md.	Wyatt & Nolting
Canton School, Baltimore, Md.	

Hotels

Rice Hotel, Elgin, Ill.	Morrison H. Vail
Emmerson Hotel Add., Baltimore	V. R. P. Saxe
Senate Hotel, Washington, D. C.	Clarence Rose
Mountaineer Hotel, Williamson, W. Va.	Meaner & Handloser
Washington Hotel, Washington, Pa.	P. L. Stoddard
Washington Duke Hotel, Durham, N. C.	Stanhope & Johnson
Charlotte Hotel, Charlotte, Va.	Stanhope & Johnson

Garages

V. E. Mount Garage, New Brunswick, N. J.	Warren Conerer
Deene, Washington, D. C.	
Garage, Cleveland	Bravermand & Havermaet
May Co. Garage, Cleveland	Lehman & Schmitt
Addition Auditorium Garage, Cleveland	Conrad & Hughes

Apartments

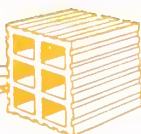
Hill Apt., Washington, D. C.	M. G. Selbey
Corroza, Washington, D. C.	
The Chaumont, Washington, D.C.	
Monroe Cts., Washington, D. C.	
Hadleigh, Washington, D. C.	
Wyman Park, Baltimore	E. Palmer
Argonne, Washington, D. C.	
Truscang, Washington, D. C.	

Miscellaneous

Pictorial Review Factory, N.Y.C.	Werner & Windolph
Potomac Electric Power Co., Washington, D. C.	Cloughton West
Laundry Bldg., Dubuque, Iowa	Fred Herr & Son
Hoffman Candy Co., Cleveland	Hadlow Hick Co.
Michigan City News, Michigan City, Ind.	Ahlgrin & Boonstra
K. of C., Baltimore	G. R. Callis, Jr.
Catholic Community, Ft. Wayne	C. R. Weatherhogg

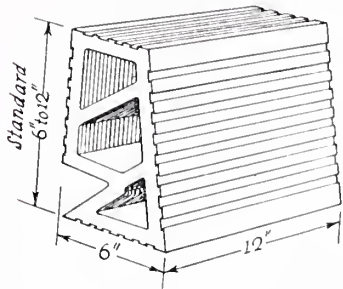


The May Co. Garage, Cleveland, Ohio.
Lehman Schmitt - P. Matzinger, Archts. S. Emerson Co., Contractor.

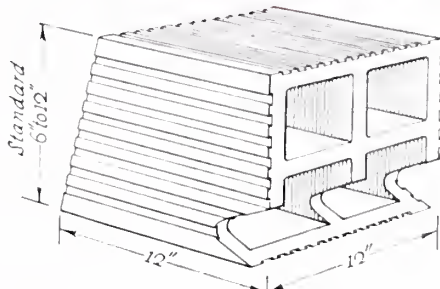




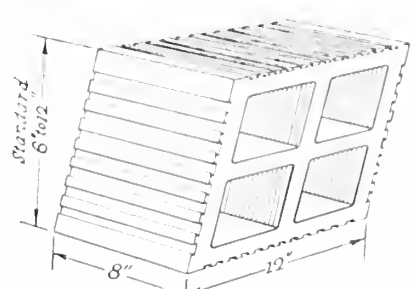
FLAT ARCH MATERIAL



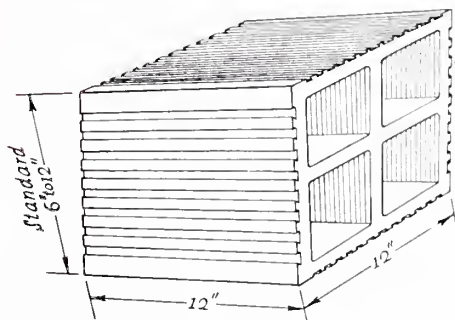
Side Construction Skew
3 cell



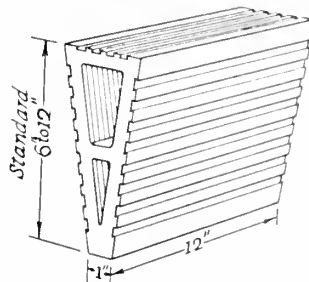
End Construction Skew
4 cell



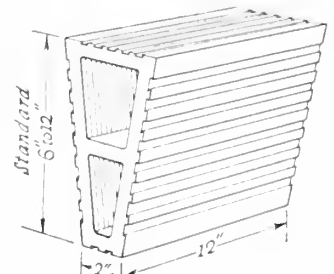
8" Inter
4 cell



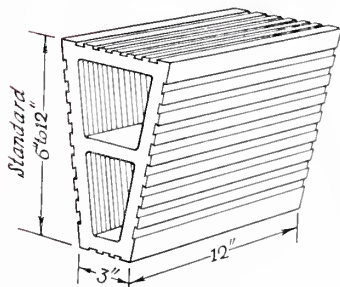
12" Inter
4 cell



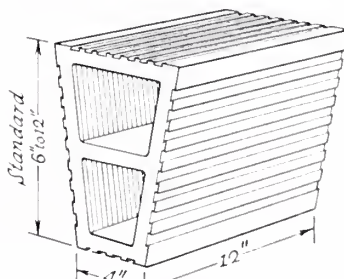
1" Key
2 cell



2" Key
2 cell



3" Key
2 cell



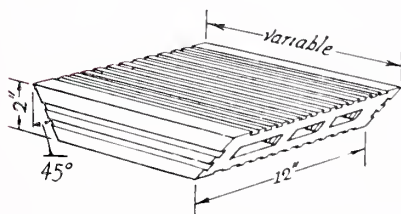
4" Key
2 cell

Uses

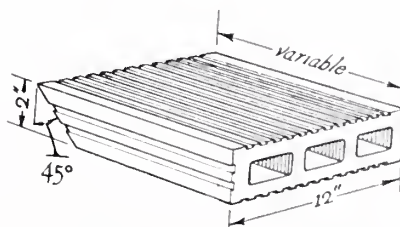
Flat Arch Material is used in flat arch floor construction illustrated and described on the following pages.

Soffits serve to bridge across gaps between hollow tile under beams and provide an all tile fire-proof covering for structural steel work, being used in connection with flat arches and girder covering.

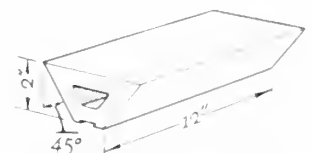
Soffits



2" End Construction Soffit
3 cell
Beveled both ends
Length variable to suit width of beam



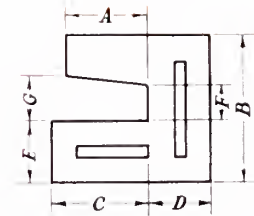
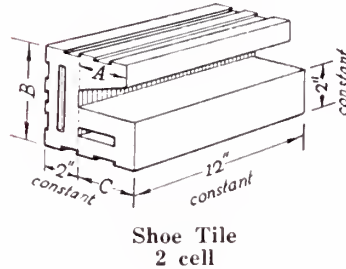
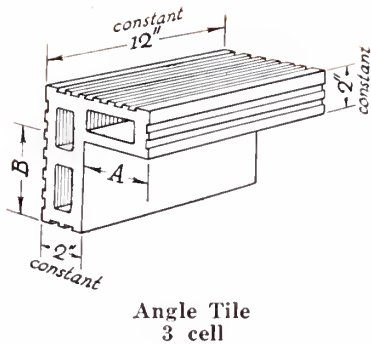
2" End Construction Soffit
3 cell
Beveled one end
Length variable to suit width of beam



2" Side Construction Soffit
1 cell
Width variable to suit width of beam



FLAT ARCH MATERIAL Angles and Shoes



Uses

As a safety measure, structural steel beams from which arches of any type spring should be protected by the use of shoe tile or angle tile and soffits with fillers, where needed.

Table of Standard Shoe Dimensions

A	B	C	D	E	F	G
12	4	2	2	2	$\frac{3}{4}$	$1\frac{1}{4}$
2	4	22	"	"	"	"
22	4	3	"	"	"	"
3	42	32	"	"	1	$1\frac{1}{2}$
3	42	4	"	"	"	"
3	42	5	"	"	"	"
3	42	6	"	"	"	"

Flat Arch Construction

Dehydration commences in concrete at 500° F. and structural steel becomes incapable of sustaining its own weight at 1700° F. It is evident therefore that the properly constructed flat arch of fire clay tile, relying on the key-stone construction for the support of both dead and live loads, with structural steel work properly fireproofed with hollow fire clay tile, is the safest type of floor construction.

While the strength developed by the flat arch is not as great as that of the segmental or curved arch, it requires less depth than the latter type, eliminates the necessity of suspended ceilings and is often more acceptable from an architectural standpoint. Correctly designed and constructed, the flat arch will develop the full strength of the supporting steel beam, which is ample for modern office and mercantile buildings and light manufacturing plants.

work and provide an all tile ceiling for plaster.

Where beams are deeper than the arch material they should be allowed to project not over two inches above and the balance below the lower surface of the finished arch, the latter sections being fireproofed, as illustrated in connection with girder covering. The top finish is the same as already described.

Construction Method When beams and arch have the same depth, the tile work is allowed to project two inches below the lower flange of the beam (See Fig. 22 and Fig. 23), and the space above the arch is filled with cinder concrete in which pipes, conduits and wood sleepers for wood floor can be laid. This cinder concrete also serves as a base for the finished concrete, marble, terrazzo or composition floor. Tile soffits placed between skews under beams fireproof the steel-

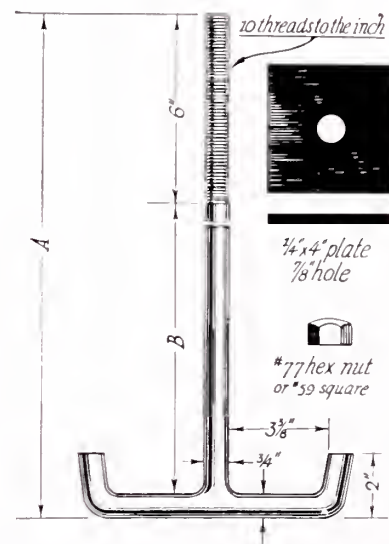


Fig. 20—Special bolt with plate and nut, used in construction of forms for flat arch



FLAT ARCH MATERIAL Flat Arch Construction

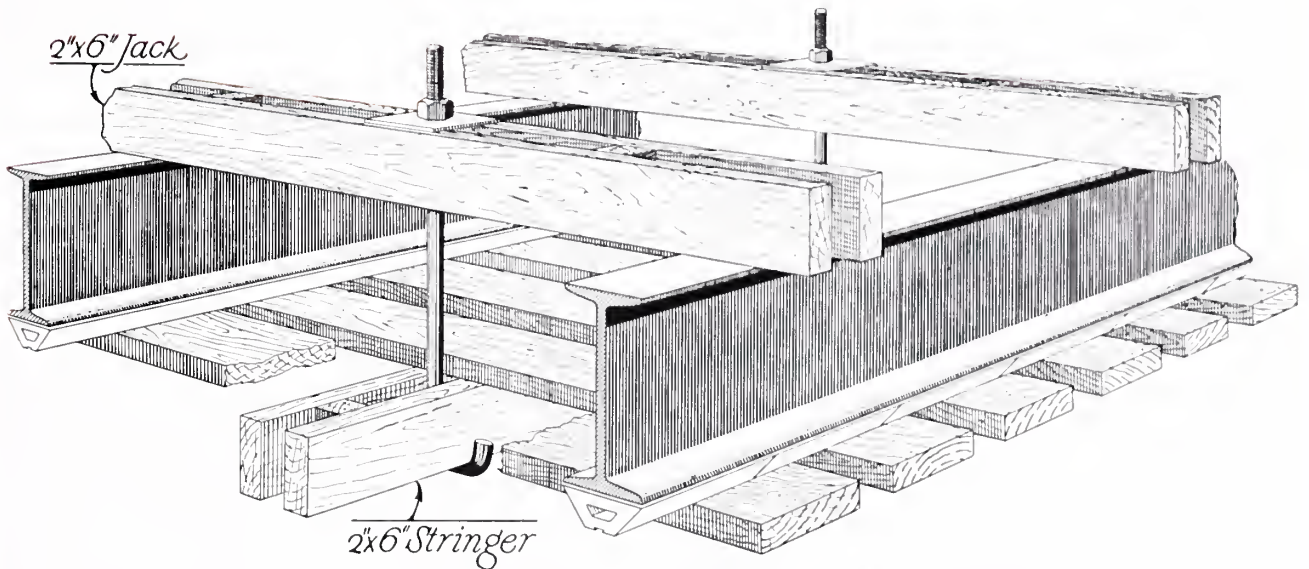


Fig. 21—Wood form for flat arch construction, showing method of applying soffits before skews are placed in position.

Laying The use of the heavy side construction skews is recommended as against the end construction type as the shells of the side construction skews afford better protection for the beams.

The inters must be set end to end in even rows from skew to key and the key placed as near as possible to the exact center of the arch.

Thrust In flat arches the key wedges the other units together and tends to produce an outward thrust against the supporting beams. This must be overcome by the use of tie rods which connect the beams and relieve them of the tendency to deflect sidewise. $\frac{3}{4}$ -inch rods spaced not over fifteen times the width of the beam flanges are generally sufficient to overcome this deflection tendency.

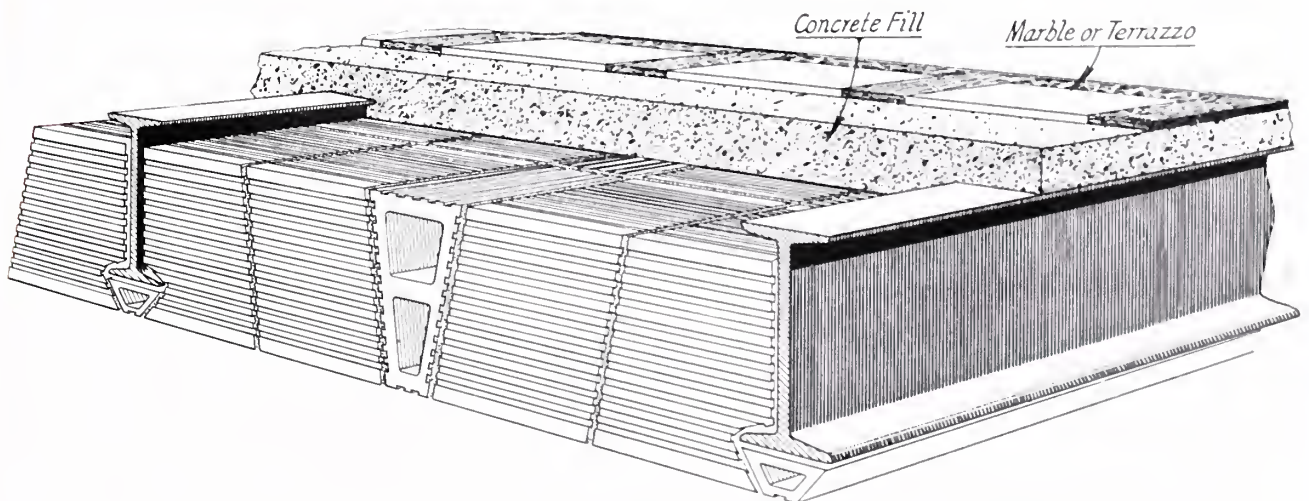


Fig. 22—Section of End Construction Flat Arch with end construction skews and with marble or terrazzo finish, illustrating placing of units and method of making concrete fill.

FLAT ARCH MATERIAL

Flat Arch Construction

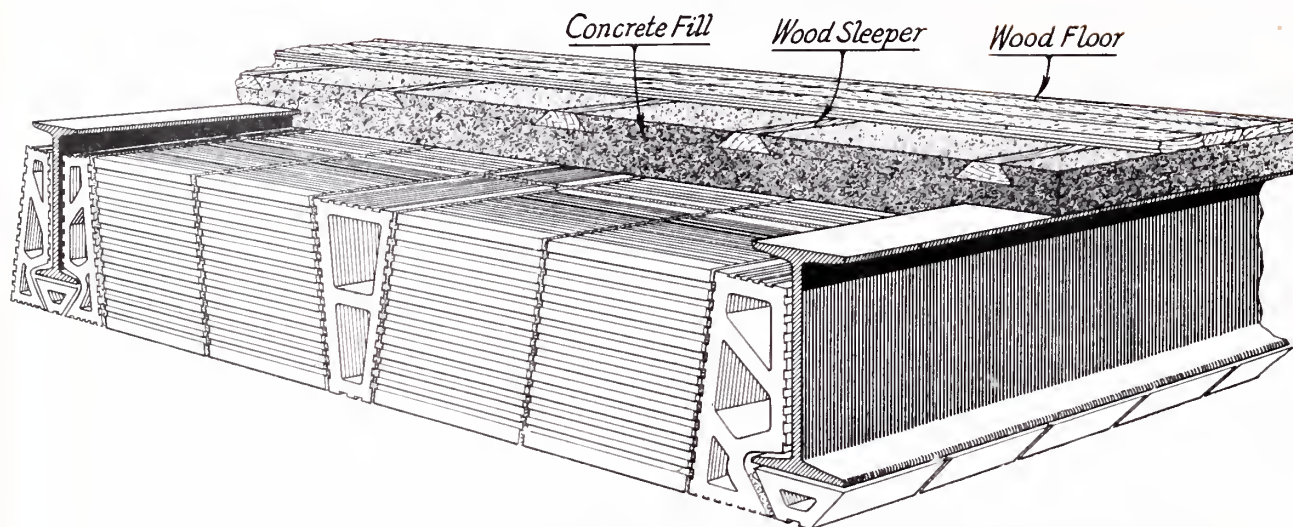


Fig. 23—Section of End Construction Flat Arch with side construction skews and with wood floor, illustrating placing of units, concrete fill, and sleepers for finished floor.

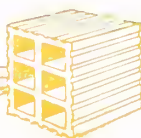
False Work The tile are set on a wood framework, as illustrated in Fig. 21. The double 2"x6" jacks with 2"x6" spreaders spaced at equal distances across the supporting beams support the 2"x6" stringer similarly constructed by means of the special hanger illustrated in Fig. 20. Two-inch planks are rested on these stringers and the soffits placed in position under the beam flanges, after which the centering is drawn up tight, giving camber if desired. This false-work may be removed as soon as the mortar has set and may be used almost indefinitely. The spacing of stringers and jacks will be determined by the span and dead weight of the arch.

See table following Segmental Arch Material for spacing of $\frac{3}{4}$ " tie rods.

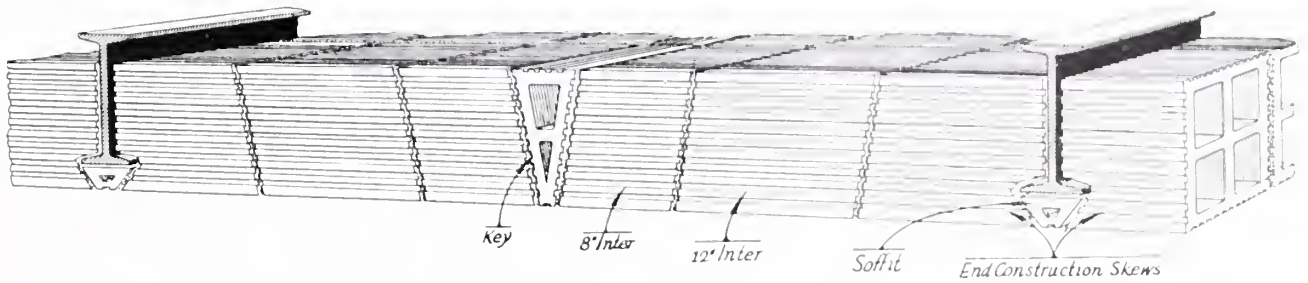
Table of Safe Loads—Flat Arches
Factor of Safety—7

Span of Arch	Depth of Arch—Inches						
	6	7	8	9	10	12	15
	Area of Block—Square Inches						
	31	34	37	40	43	49	58
3' 0"	458	588	735	901	1084	1487	2210
3' 3"	386	496	622	763	916	1262	1877
3' 6"	330	424	531	653	785	1083	1612
3' 9"	284	365	459	565	679	938	1398
4' 0"	247	318	399	493	593	820	1223
4' 3"	216	278	350	433	521	722	1079
4' 6"	190	245	309	382	461	640	951
4' 9"	168	217	274	340	410	571	855
5' 0"	149	193	244	304	367	511	767
5' 3"		172	218	272	330	460	691
5' 6"		154	196	245	297	416	626
5' 9"		139	176	222	269	378	569
6' 0"			159	201	244	344	518
6' 3"			144	183	222	314	474
6' 6"			131	166	203	287	435
6' 9"				152	186	264	400
7' 0"				139	170	243	369
7' 6"					144	206	315
8' 0"						177	272
8' 6"						153	236
9' 0"						132	205
9' 6"							180
10' 0"							158

The weight of the arch has been deducted from the safe loads given above, so that only the dead load of the concrete fill, plastering, etc., need be deducted to obtain the net safe live load for any arch and span.



FLAT ARCH MATERIAL

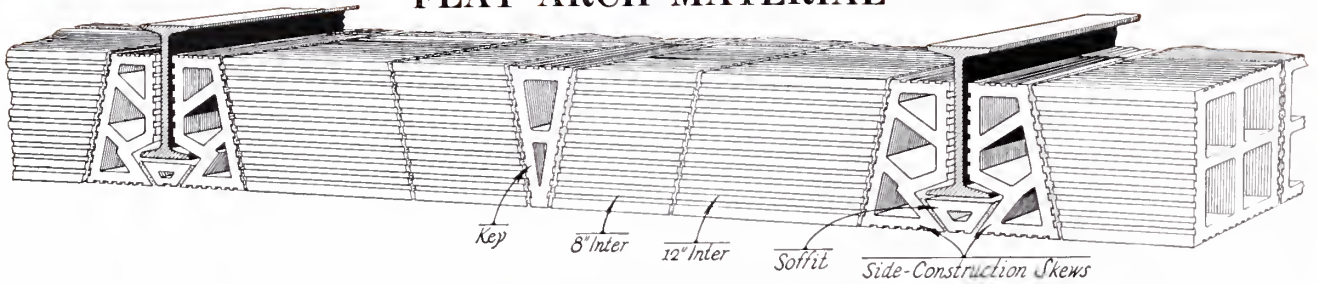


Setting Schedule—End Construction Arches With End Construction Skews

Span	Number 12" E. C. Skews	Number 12" Inters	Number 8" Inters	Size Key	Span	Number 12" E. C. Skews	Number 12" Inters	Number 8" Inters	Size Key
2' 10"	2	0	1	1"	6' 0"	2	3	1	2"
2' 11"	2	0	1	2"	6' 1"	2	3	1	3"
					6' 2"	2	3	1	4"
3' 0"	2	0	1	3"	6' 3"	2	4	0	1"
3' 1"	2	0	1	4"	6' 4"	2	4	0	2"
3' 2"	2	1	0	1"	6' 5"	2	4	0	3"
3' 3"	2	1	0	2"	6' 6"	2	4	0	4"
3' 4"	2	1	0	3"	6' 7"	2	3	2	1"
3' 5"	2	1	0	4"	6' 8"	2	3	2	2"
3' 6"	2	0	2	1"	6' 9"	2	3	2	3"
3' 7"	2	0	2	2"	6' 10"	2	3	2	4"
3' 8"	2	0	2	3"	6' 11"	2	4	1	1"
3' 9"	2	0	2	4"					
3' 10"	2	1	1	1"	7' 0"	2	4	1	2"
3' 11"	2	1	1	2"	7' 1"	2	4	1	3"
					7' 2"	2	4	1	4"
4' 0"	2	1	1	3"	7' 3"	2	5	0	1"
4' 1"	2	1	1	4"	7' 4"	2	5	0	2"
4' 2"	2	2	0	1"	7' 5"	2	5	0	3"
4' 3"	2	2	0	2"	7' 6"	2	5	0	4"
4' 4"	2	2	0	3"	7' 7"	2	4	2	1"
4' 5"	2	2	0	4"	7' 8"	2	4	2	2"
4' 6"	2	1	2	1"	7' 9"	2	4	2	3"
4' 7"	2	1	2	2"	7' 10"	2	4	2	4"
4' 8"	2	1	2	3"	7' 11"	2	5	1	1"
4' 9"	2	1	2	4"					
4' 10"	2	2	1	1"	8' 0"	2	5	1	2"
4' 11"	2	2	1	2"	8' 1"	2	5	1	3"
					8' 2"	2	5	1	4"
5' 0"	2	2	1	2"	8' 3"	2	6	0	1"
5' 1"	2	2	1	3"	8' 4"	2	6	0	2"
5' 2"	2	2	1	4"	8' 5"	2	6	0	3"
5' 3"	2	3	0	1"	8' 6"	2	6	0	4"
5' 4"	2	3	0	2"	8' 7"	2	5	2	1"
5' 5"	2	3	0	3"	8' 8"	2	5	2	2"
5' 6"	2	3	0	4"	8' 9"	2	5	2	3"
5' 7"	2	2	2	1"	8' 10"	2	5	2	4"
5' 8"	2	2	2	2"	8' 11"	2	6	1	1"
5' 9"	2	2	2	3"					
5' 10"	2	2	2	4"	9' 0"	2	6	1	2"
5' 11"	2	3	1	1"					



FLAT ARCH MATERIAL

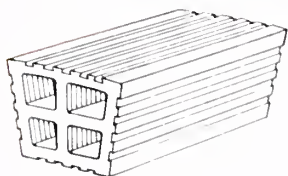


Setting Schedule—End Construction Arches With Side Construction Skews

Span	Number 6" S. C. Skews	Number 12" Inters	Number 8" Inters	Size Key	Span	Number 6" S. C. Skews	Number 12" Inters	Number 8" Inters	Size Key
1' 10"	2	0	1	1"	5' 6"	2	4	0	4"
1' 11"	2	0	1	2"	5' 7"	2	3	2	1"
2' 0"	2	0	1	3"	5' 8"	2	3	2	2"
2' 1"	2	0	1	4"	5' 9"	2	3	2	3"
2' 2"	2	1	0	1"	5' 10"	2	3	2	4"
2' 3"	2	1	0	2"	5' 11"	2	4	1	1"
2' 4"	2	1	0	3"	6' 0"	2	4	1	2"
2' 5"	2	1	0	4"	6' 1"	2	4	1	3"
2' 6"	2	0	2	1"	6' 2"	2	4	1	4"
2' 7"	2	0	2	2"	6' 3"	2	5	0	1"
2' 8"	2	0	2	3"	6' 4"	2	5	0	2"
2' 9"	2	0	2	4"	6' 5"	2	5	0	3"
2' 10"	2	1	1	1"	6' 6"	2	5	0	4"
2' 11"	2	1	1	2"	6' 7"	2	4	2	1"
3' 0"	2	1	1	3"	6' 8"	2	4	2	2"
3' 1"	2	1	1	4"	6' 9"	2	4	2	3"
3' 2"	2	2	0	1"	6' 10"	2	4	2	4"
3' 3"	2	2	0	2"	6' 11"	2	5	1	1"
3' 4"	2	2	0	3"	7' 0"	2	5	1	2"
3' 5"	2	2	0	4"	7' 1"	2	5	1	3"
3' 6"	2	1	2	1"	7' 2"	2	5	1	4"
3' 7"	2	1	2	2"	7' 3"	2	6	0	1"
3' 8"	2	1	2	3"	7' 4"	2	6	0	2"
3' 9"	2	1	2	4"	7' 5"	2	6	0	3"
3' 10"	2	2	1	1"	7' 6"	2	6	0	4"
3' 11"	2	2	1	2"	7' 7"	2	5	2	1"
4' 0"	2	2	1	3"	7' 8"	2	5	2	2"
4' 1"	2	2	1	4"	7' 9"	2	5	2	3"
4' 2"	2	3	0	1"	7' 10"	2	5	2	4"
4' 3"	2	3	0	2"	7' 11"	2	6	1	1"
4' 4"	2	3	0	3"	8' 0"	2	6	1	2"
4' 5"	2	3	0	4"	8' 1"	2	6	1	3"
4' 6"	2	2	2	1"	8' 2"	2	6	1	4"
4' 7"	2	2	2	2"	8' 3"	2	7	0	1"
4' 8"	2	2	2	3"	8' 4"	2	7	0	2"
4' 9"	2	2	2	4"	8' 5"	2	7	0	3"
4' 10"	2	3	1	1"	8' 6"	2	7	0	4"
4' 11"	2	3	1	2"	8' 7"	2	6	2	1"
5' 0"	2	3	1	2"	8' 8"	2	6	2	2"
5' 1"	2	3	1	3"	8' 9"	2	6	2	3"
5' 2"	2	3	1	4"	8' 10"	2	6	2	4"
5' 3"	2	4	0	1"	8' 11"	2	7	1	1"
5' 4"	2	4	0	2"	9' 0"	2	7	1	2"
5' 5"	2	4	0	3"					



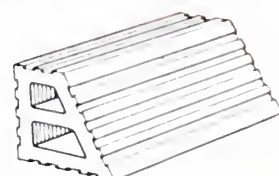
SEGMENTAL ARCH MATERIAL



Inter for Segmental Arch
4 cell
Made in 6" (Standard)
thickness

Uses

Segmental arch material—inters and skews enter into the construction of all segmental arches.



Skew for Segmental Arch
2 cell
Made in 6" (Standard)
thickness

Segmental Arch Construction

Wherever a flat ceiling is not required, as in warehouses, lofts, factories, public garages, sidewalks, etc., the segmental arch provides the strongest and most economical type of floor construction.

The six-inch arch is in most general use, developing as much strength in ordinary cases as the eight-inch arch of equal rise.

While the depth of the arch determines its strength, it must be remembered that the deeper the arch, the greater the weight on the steel beams. Any segmental arch will develop a carrying strength in excess of the beam from which it springs.

Where a flat ceiling is desired, it may be obtained by the use of metal lath stretched between beams.

Construction Method The constructional methods employed in segmental arch construction are practically the same as those used in arches of the flat type, the space above the arch being filled with cinder concrete to a depth of about two inches at the key. Hollow tile fillers may be embedded in the concrete in the lowest portions of the arch to lessen dead weight. Conduit and piping also may be carried in the cinder concrete.

Laying Segmental arch inters and skews are designed for side construction laying. The two shells and continuous reinforcing web provide ample strength.

False Work The units of segmental arches are laid on planks which are supported by two-inch ribs curved to fit the form of the arch. These rest on planks supported from beneath or by means of jacks, stringers and the special hanger.

The spacing of supports for the false work will, of course, depend on the span of the arch, its weight, etc. The material may be removed after the mortar has set, and used again.

Thrust As in the case of the flat arch, the inters wedged against each other thrust against the beam which has a tendency to deflect sidewise. This deflection tendency is overcome by the use of steel tie rods, properly spaced.

The tie rods serve most effectively when placed near the bottom of the beams. If a flat ceiling is not used the exposed portions of the rods should be painted as a matter of appearance and as a protection against rust.

The rods may, however, be placed higher and hidden by the arch, in which case the end spans should be made of double or forked rods set crossing each other.

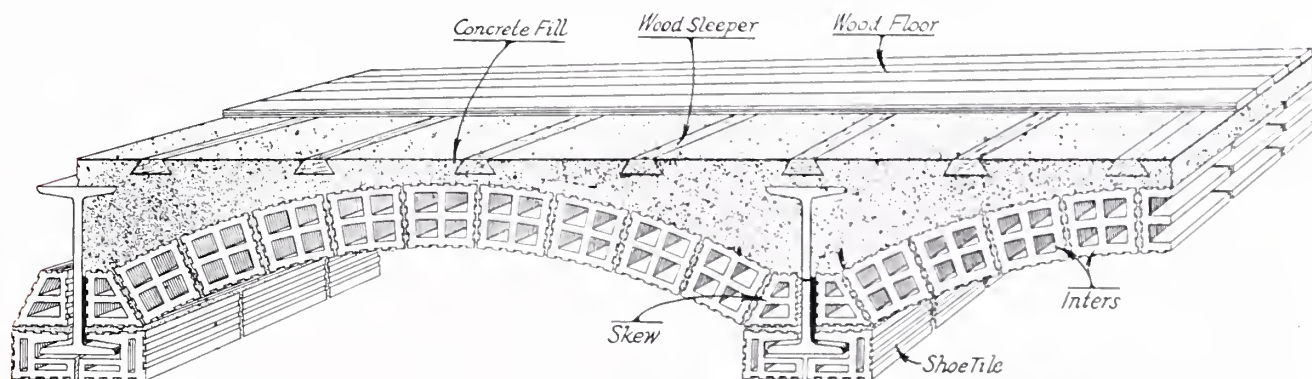


Fig. 24—Section of Segmental Arch Floor, illustrating method of protecting exposed portions of girder, making concrete fill and placing sleepers for finished wood floor.



SEGMENTAL ARCH MATERIAL *Finished Concrete Floor*

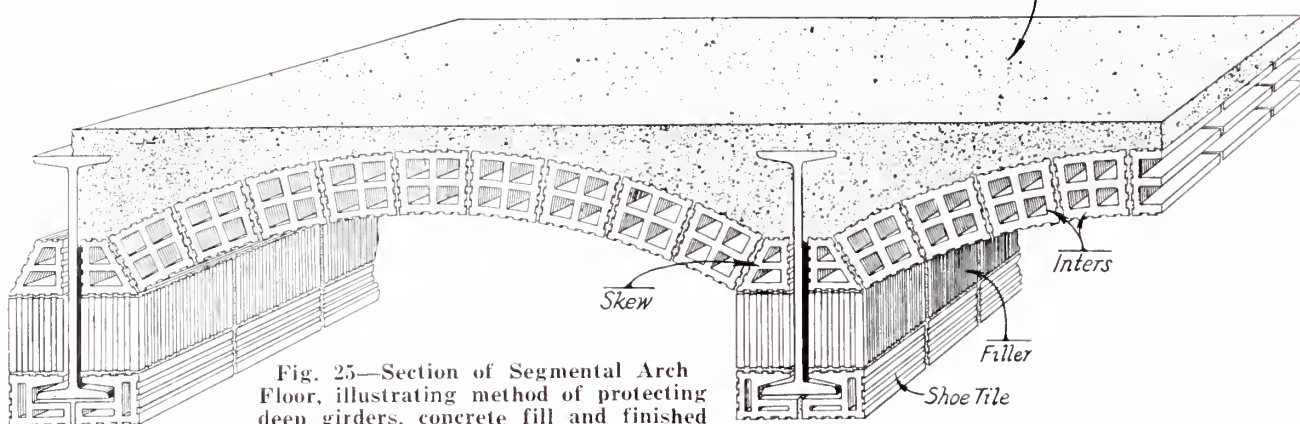


Fig. 25—Section of Segmental Arch Floor, illustrating method of protecting deep girders, concrete fill and finished concrete floor.

TABLE OF SAFE LOADS—6" Segmental Arch

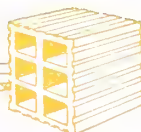
Span	Rise—Inches—Per Foot of Span					
	$\frac{3}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$	2
4' 0"	902	1184	1485	1740	1986	2233
4' 6"	792	1044	1313	1539	1775	1975
5' 0"	709	957	1172	1379	1592	1773
5' 6"	641	864	1062	1266	1439	1619
6' 0"	585	788	969	1154	1315	1476
6' 6"	551	724	902	1058	1218	1358
7' 0"	508	669	834	981	1127	1264
7' 6"	471	621	774	920	1049	1176
8' 0"	439	588	724	859	987	1099
8' 6"	411	551	678	806	926	1037
9' 0"	386	518	645	758	871	977
9' 6"	364	489	608	721	823	923
10' 0"	344	462	576	683	784	879
10' 6"	331	438	546	648	744	832
11' 0"	315	421	519	617	709	794
11' 6"	299	401	499	592	680	761
12' 0"	285	383	477	566	649	727
12' 6"	273	366	456	541	621	696

The weight of the arch has been deducted from the safe loads given above, so that only the dead load of the concrete fill, plastering, etc., need be deducted to obtain the net safe live load for any arch and span.

MAXIMUM SPACING OF $\frac{3}{4}$ " TIE RODS—For Both Flat and Segmental Arches Loads of 100 Pounds Per Square Foot

Span Feet	Effective Rise of Arch—R*—in Inches											
	4	5	6	7	8	9	10	11	12	13	14	15
3	14.3											
4	8.1	10.1										
5	5.2	6.4	12.1	14.1								
6	3.6	4.5	7.7	9.0	10.3	11.6	12.9	14.2				
7		3.3	5.4	6.3	7.2	8.1	8.9	9.8	10.7	11.6	12.5	13.4
8			3.9	4.6	5.3	5.9	6.6	7.2	7.9	8.5	9.2	9.9
9			3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.6
10					3.2	3.6	4.0	4.4	4.8	5.2	5.6	6.0
							3.2	3.5	3.9	4.2	4.5	4.8

*In Flat Arches the Effective Rise—"R"—may be taken at 2.4 inches less than the arch depth. In Segmental Arches, "R" is equal to the vertical distance between the highest point of the concave surface and the springing line or chord.



GIRDER COVERING

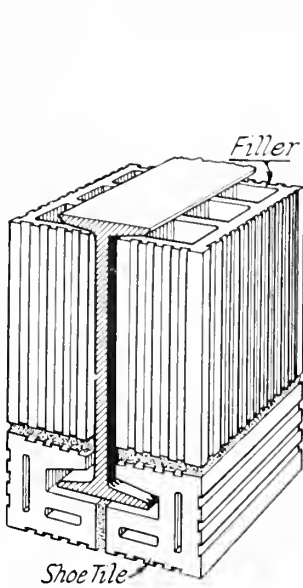


Fig. 26—Girder protected by use of shoes and one piece filler.

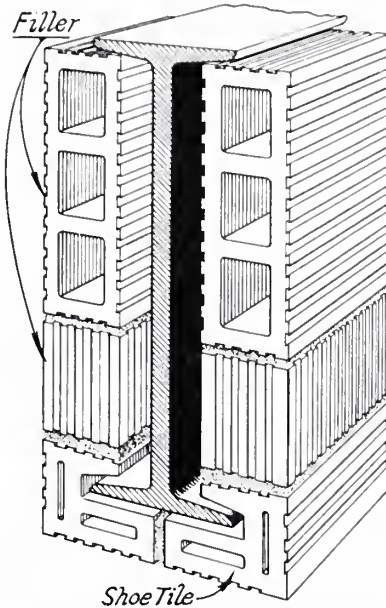


Fig. 27—Showing application to larger girders using more than one piece for filler.

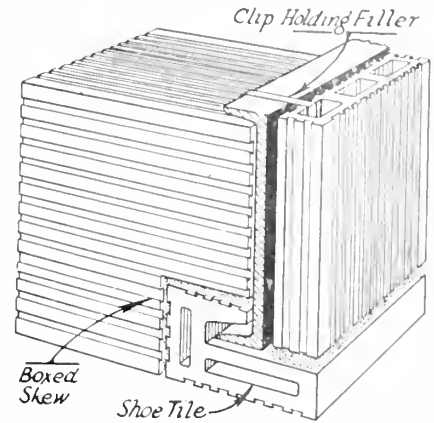


Fig. 28—Facia Covering at Stairwells, etc., with arch on opposite side.

Steel Girder Protection

The fireproofing of structural steel beams which are generally called upon to carry heavy or vital loads is an important question which finds its best solution in the use of hollow tile.

In the long run, this method of girder protection,

in addition to being by far the most effective, is considerably less expensive than the solid concrete covering. It has a much greater fire protective value, is laid without the use of expensive forms and considerably decreases the dead weight.

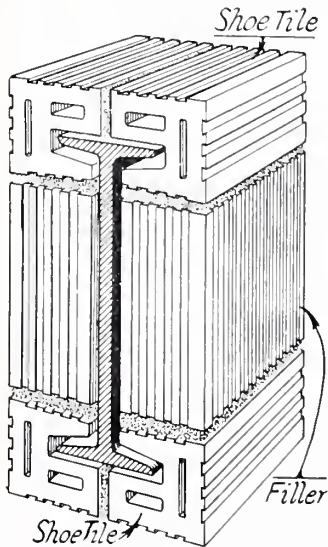


Fig. 29—Method of fire-proofing girders exposed on all sides.

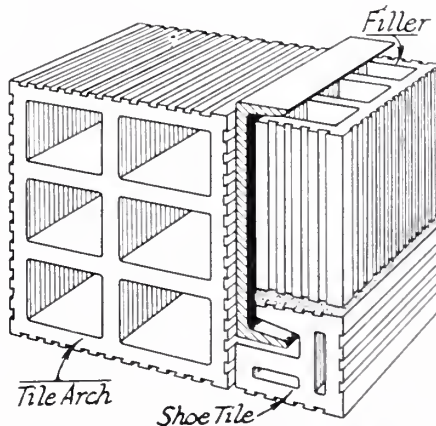


Fig. 30—Facia protection for steel channel, back of channel turned from opening.

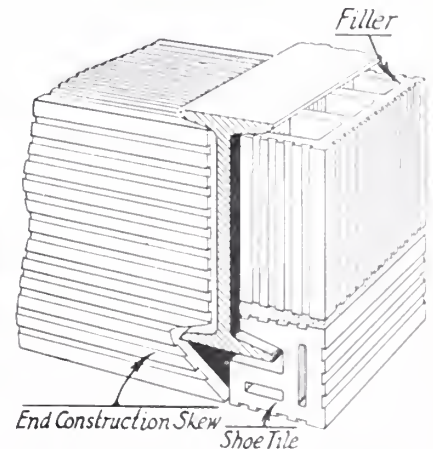


Fig. 31—Facia protection of steel channel, back of channel turned toward opening. Note method of holding filler in position by use of metal clip.

GIRDER COVERING

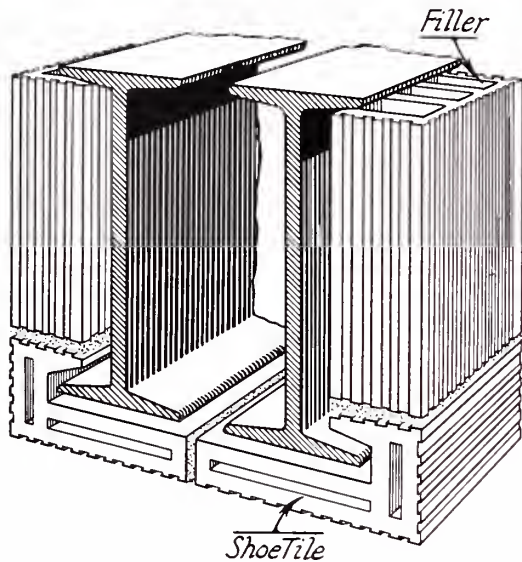


Fig. 32—Shoe method of protecting double girders.

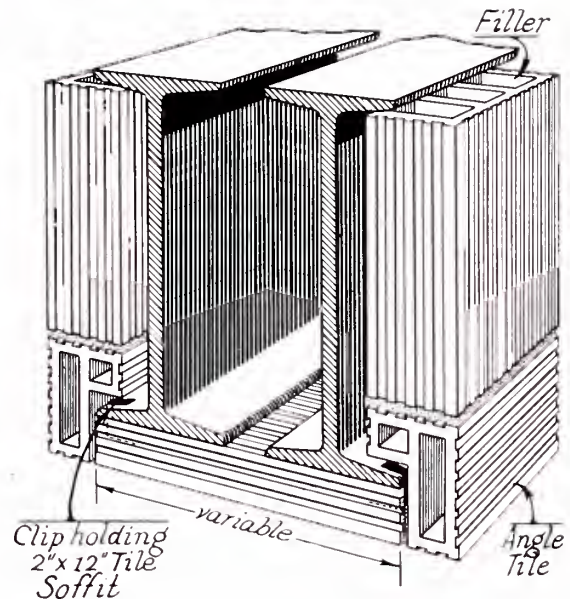


Fig. 33—Angle and soffit method of protecting double girders. Note method of holding soffit in position by use of metal clips.

Application Two methods are employed in the fireproofing of steel girders—the shoe method, and the angle and soffit method. In either case there should be a good bed of mortar between the shoe or angle and the flanges of the girder.

The Shoe Method

The shoe is fitted over the flange of the girder, as shown in the illustrations, the width of the lower projection, "C", being varied to provide an all tile protection for the lower face of the beam flange. Dimensions "A" and "B" should be sufficient to give the shoe a good grip on the beam flange.

Tile fillers protect the exposed portions of the web as illustrated in Fig. 26, Fig. 27, Fig. 28 and Fig. 29. Floor slabs or arches may be constructed to rest on either the shoe or the filler.

Where girders are exposed on all sides, the use of the tile shoes is repeated over the top flange, producing a square finished all tile protection. (See Fig. 29.)

Channels also are covered by the use of the tile shoe and filler (See Fig. 30 and Fig. 31). It should be noted that where the back of the channel is exposed metal clips of 18 or 19 gauge band iron, three-quarters to one inch wide, are used to hold the filler in place.

This method is useful in the fireproofing of all single beams and double beams where the distance between the tips of the outside flanges is not too great.

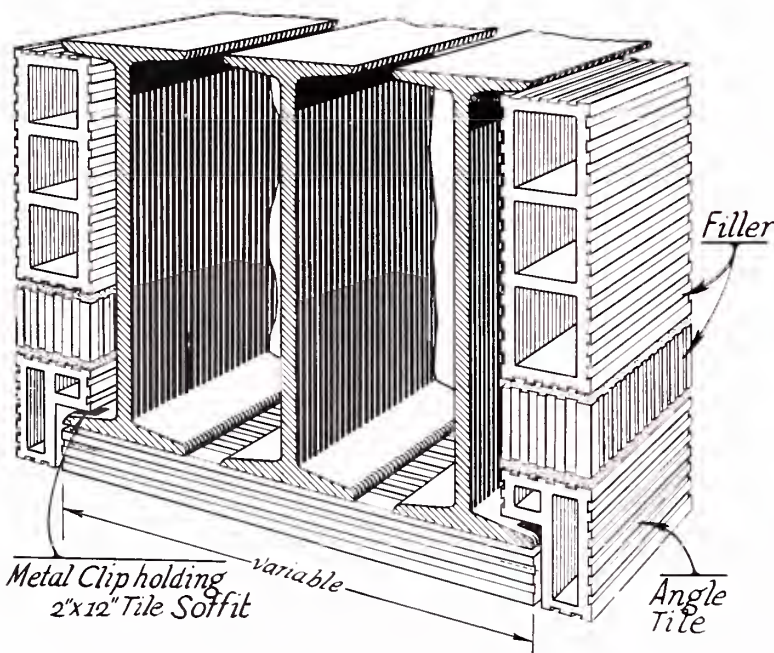


Fig. 34—Angle and soffit method of protecting triple girders, showing use of metal clips to retain soffit

GIRDER COVERING

The Angle and Soffit Method This method is preferred by some architects over the shoe method. While also applicable to large single and double beams, it provides the only proper method of protecting triple or widely spaced double beams. (Fig. 33, Fig. 34 and Fig. 36.)

Tile fillers are employed in the same manner as in the shoe method and floor slabs or arches may rest on the angle or filler.

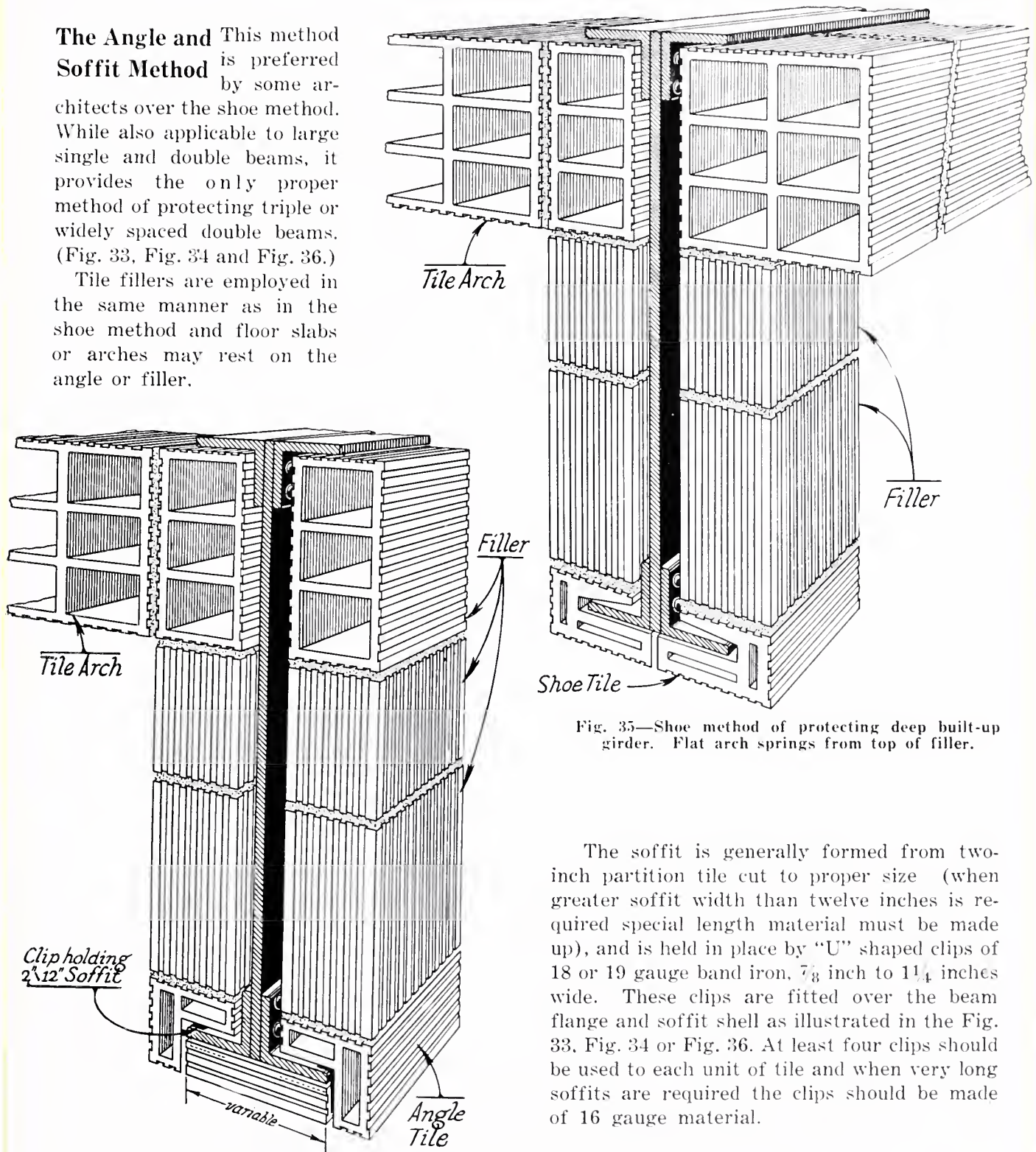


Fig. 35—Shoe method of protecting deep built-up girder. Flat arch springs from top of filler.

The soffit is generally formed from two-inch partition tile cut to proper size (when greater soffit width than twelve inches is required special length material must be made up), and is held in place by "U" shaped clips of 18 or 19 gauge band iron, $\frac{7}{8}$ inch to $1\frac{1}{4}$ inches wide. These clips are fitted over the beam flange and soffit shell as illustrated in the Fig. 33, Fig. 34 or Fig. 36. At least four clips should be used to each unit of tile and when very long soffits are required the clips should be made of 16 gauge material.

Fig. 36—Soffit and angle method of protecting deep built-up girder with fascia covering on one side.

GIRDER COVERING

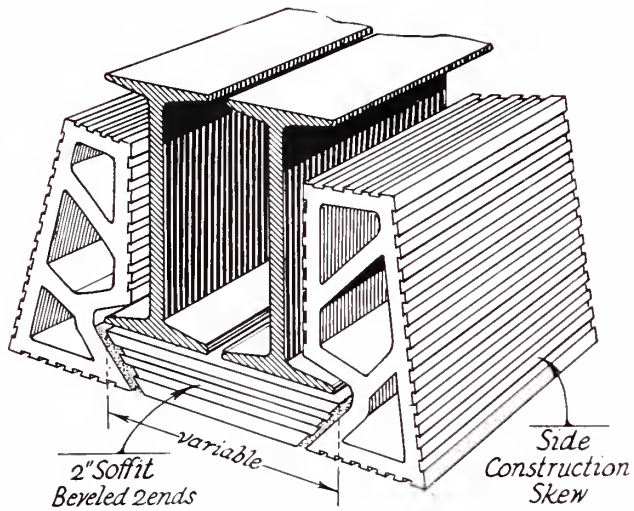


Fig. 37—Illustrating method of protecting double beams supporting end construction flat arch floor with side construction skews.

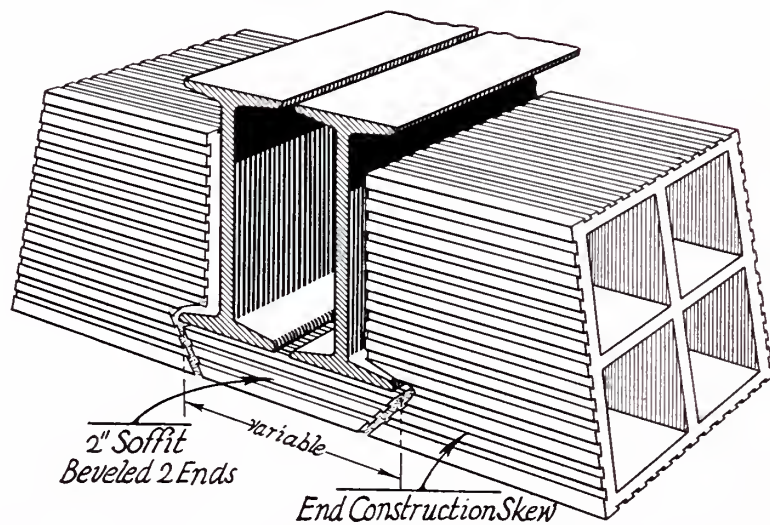
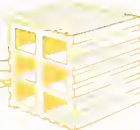
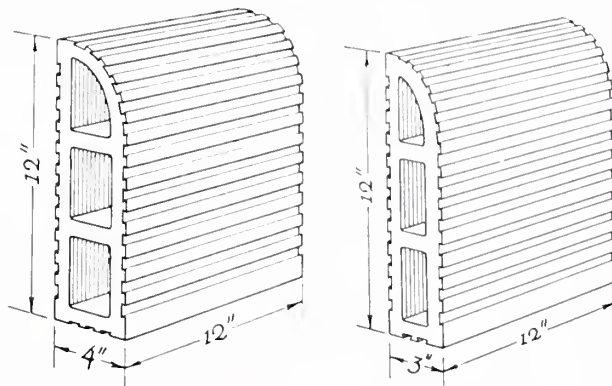


Fig. 38—Illustrating method of protecting double beams supporting end construction flat arch floor with end construction skews.



COLUMN COVERING

Round Corner Column Covering



3"x12"x12" Round
Corner Column
Covering
3 cell
Wt. Approx. 15 lbs.

4"x12"x12" Round
Corner Column
Covering
3 cell
Wt. Approx. 16 lbs.

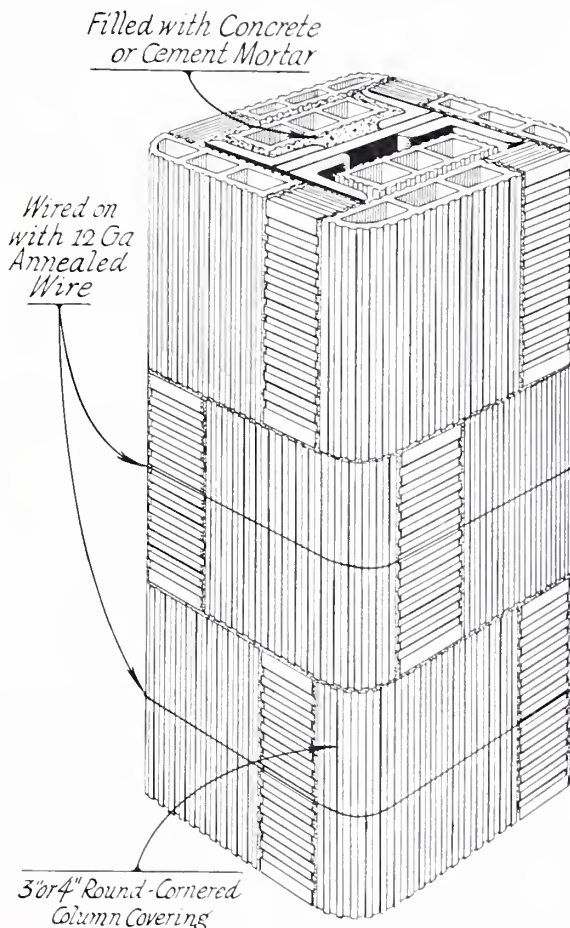


Fig. 39—Application of round corner column covering to built-up "I" Column, showing use of partition tile "pieces" as fillers and method of wiring tile in place.

Uses

Round Corner Column Covering, as the name implies, is used in the fireproofing of steel and cast iron columns, being laid in combination with ordinary partition tile fillers.

Column Fireproofing

The fireproofing of steel columns and, in fact, all vertical steelwork serving to support floor or wall load in skeleton frame structures is one of the most important questions confronting the architect and builder, and one which demands the utmost careful consideration.

Hollow tile fireproofing by reason of its light weight, economy of application and great fire-resistive value is undoubtedly best adapted for this purpose.

Construction When the hollow tile fireproofing is used the entire height of the column must be solidly encased in a continuous covering of three-inch or four-inch hollow partition tile.

Tile column covering must never be laid on finished wood or on cinder concrete floors but should start from the fireproof floor construction. This should first be scraped and swept clean of all mortar droppings and other debris. Where there is a difference in level between the tops of beams and the top of the floor construction this difference must be made up by filling with slabs of broken tile bedded in cement mortar to provide a level base for the starting course.

The covering should be built tight against the ceiling above with a full mortar joint, but should not be wedged with tile, slate or other material.

Each course should be bound on with 12-gauge annealed wire or "U" shaped clips of 16-gauge strap iron slipped over the shells of all abutting blocks in each course and the channel spaces filled with hollow tile of the proper size, and concrete.

Pipe Spaces Columns should always be fireproofed independent of duct coverings and other enclosures. Piping, conduits and ducts should be placed outside the column covering with a solid tile wall at least three inches thick between column and pipe space.

Under no circumstance should piping or conduits be placed in the channel spaces. Where

COLUMN COVERING

Column Fireproofing

*Filled with Concrete
or Cement Mortar*

*Wired on
with 12 Ga.
Annealed
Wire*

*2", 3" or 4"
Column
Covering*

Fig. 40—Built-up I column protected with square column covering (partition tile.)

it is desired to conserve space, the two-inch tile or even metal lath may be used for enclosing pipe ducts alongside columns.

Main partition or division walls and stair or elevator enclosures may be built into the column covering, but sub-dividing partitions should be built separately and anchored to the columns by metal ties built into the column covering or by the use of hooks or metal bands which may be placed by cutting into the mortar joints of the column where required.

The three-inch or four-inch column covering may be used for ordinary requirement except where building laws require a minimum thickness

of four inches of tile, while the two-inch tile may be used where it is desired to conserve space and the ceiling height is not too great.

Hollow tile column fireproofing should be laid with the cells vertical, although "pieces" with the cells horizontal are used as fillers.

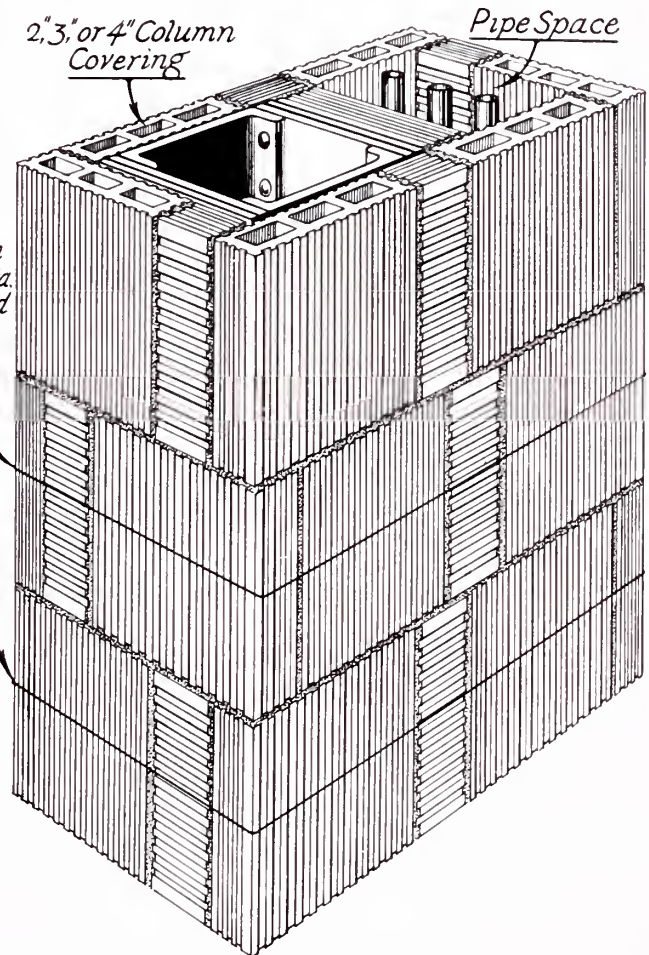
Round Corner Column covering is provided for use where a round corner column enclosure is desired. The use of these round corner tile eliminates sharp corners from which the plaster is easily chipped.

Fig. 41—Built-up box girder protected with square column covering (partition tile) showing method of constructing pipe ducts.

*2", 3" or 4" Column
Covering*

Pipe Space

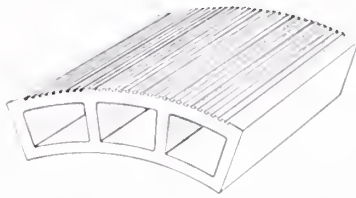
*Wired on
with 12 Ga.
Annealed
Wire*



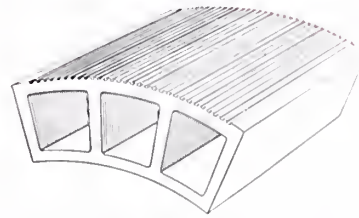


COLUMN COVERING

Round Column Covering



3" Round Column Covering
3 cell
Wt. Approx. 15 lbs.



4" Round Column Covering
3 cell
Wt. Approx. 16 lbs.

3" or 4" Round
Column Covering

*To be filled
with Concrete
and Scrap Tile*

*Wired on
with 12 Ga.
Annealed
Wire*

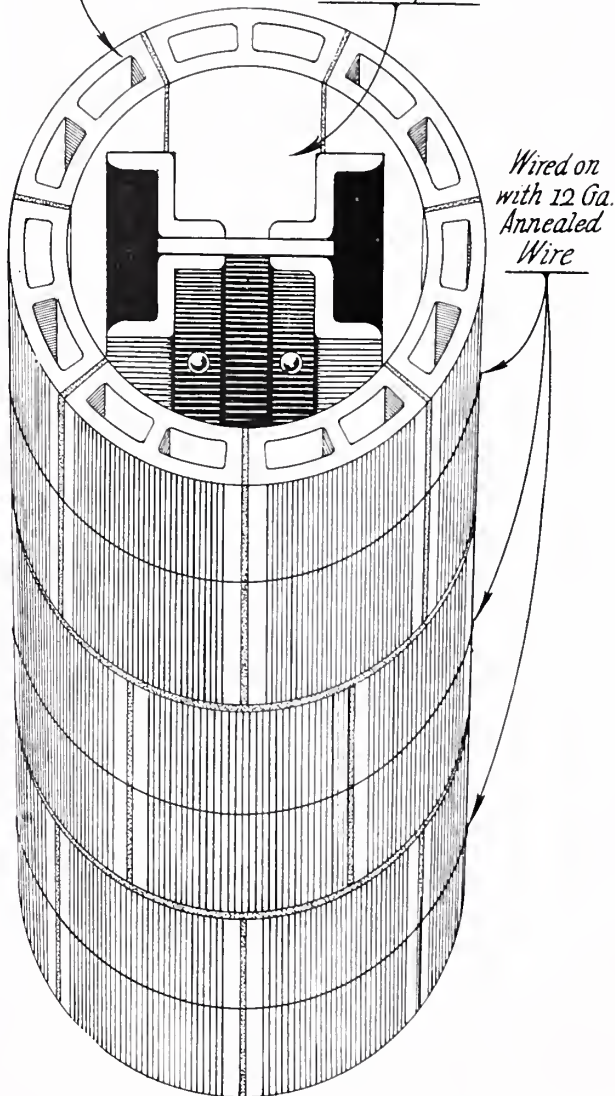


Fig. 42—Application of round column covering to the protection of built-up column.

Uses

Round column covering is used wherever it is desired that the finished column be circular in cross section, and for the fireproof lining of steel stacks. Other uses, such as the construction of ornamental round columns and curved walls of short radius will suggest themselves.

Round Columns

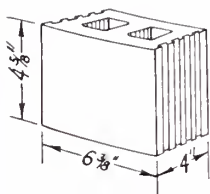
Round column coverings for any type of structural steel or cast iron column may be provided by the use of our round column coverings. Round column covering tile of various radii are furnished to provide for column coverings of varying diameters. The method of construction is the same as that described in connection with the square and round corner column covering. The space between structural work and fireproof covering is filled with concrete and scrap tile.

Stack Lining

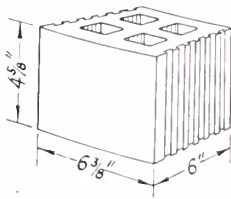
Round column covering provides an ideal lining for medium-sized steel stacks. The fireproof lining serves to strengthen the stacks and protects the steel from the ravages of heat and chemical action.



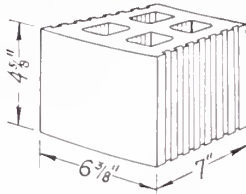
RADIAL BRICK



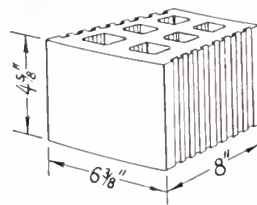
4" Radial Brick
2 cell
Wt. Approx. 7 lbs.



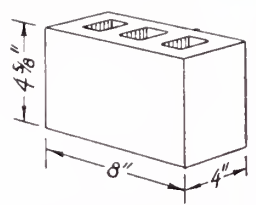
6" Radial Brick
4 cell
Wt. Approx. 9 1/2 lbs.



7" Radial Brick
4 cell
Wt. Approx. 11 lbs.



8" Radial Brick
6 cell
Wt. Approx. 12 1/2 lbs



4" Square Brick
3 cell
Wt. Approx. 10 lbs.

Radial Brick Chimneys

When all points are considered, the radial brick chimney proves itself the most satisfactory. While the first cost is generally higher than that of a steel stack of equal size, it will be found in practically every case that the first cost is the last. Radial fire clay brick are unaffected by the elements, extremes of temperature and chemical action.

The radial brick chimney properly constructed on a firm foundation is practically indestructible.

Radial brick chimneys have been built to a height of 571 feet with a flue diameter of 25 feet, and 350 feet with a flue diameter of 8 feet, and have been standing for thirty years without repairs.

Construction With the four sizes illustrated, it is possible to construct radial brick chimneys of any diameter, cross sectional thickness and taper required. The square bricks are used in the construction of square or polygon bases, and where the breeching enters the chimney.

Laying The radial brick are laid in a thin even bed of rich cement mortar with the joints broken by the use of bricks of different lengths. (See Fig. 44.)

The cross sectional thickness is decreased to provide for taper by the use of smaller or fewer tile.

The boilers, the coal used, temperatures, geographical location, etc., affect the determination of the most economical and efficient size of chimney and these are problems which can best be left to engineers specializing in stack work.

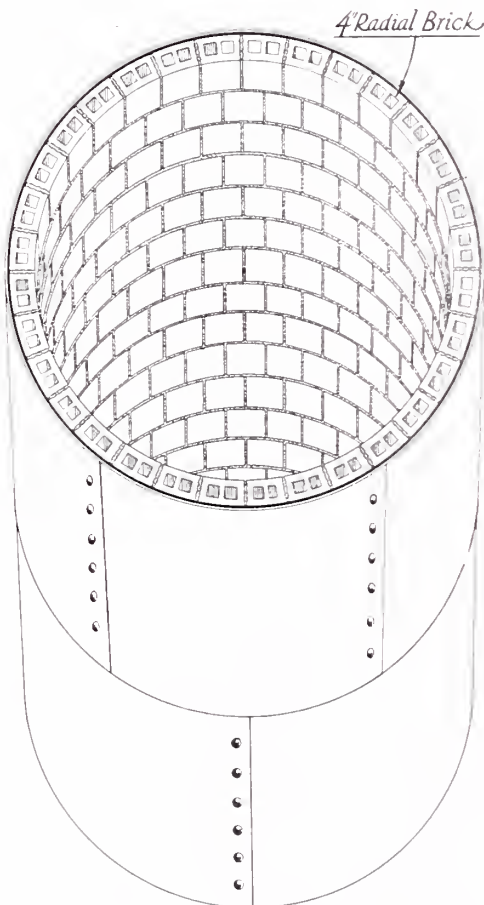


Fig. 43—Method of employing radial brick in lining steel stacks.

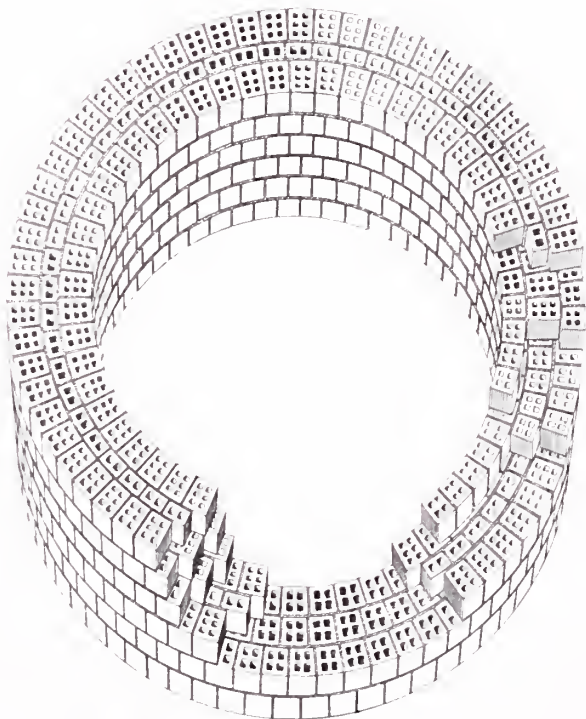
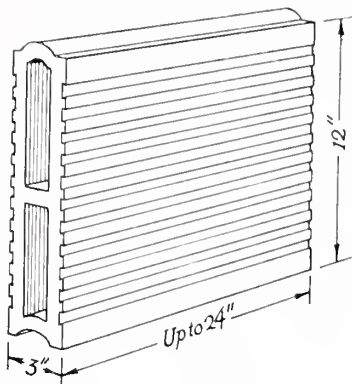


Fig. 44—Method of constructing radial brick stack showing how broken joints are obtained by the use of material of different sizes.

BOOK TILE



3"x12" Book Tile
2 cell
Weight varies with length

Uses

Book Tile, named on account of their shape, are used in the construction of raised floors for toilets, etc., bulkhead and ceiling construction in store display windows and in suspended ceilings and fireproof flat and gable roofs where the live load is light and a light roof is desired.

Book Tile In Roof Construction

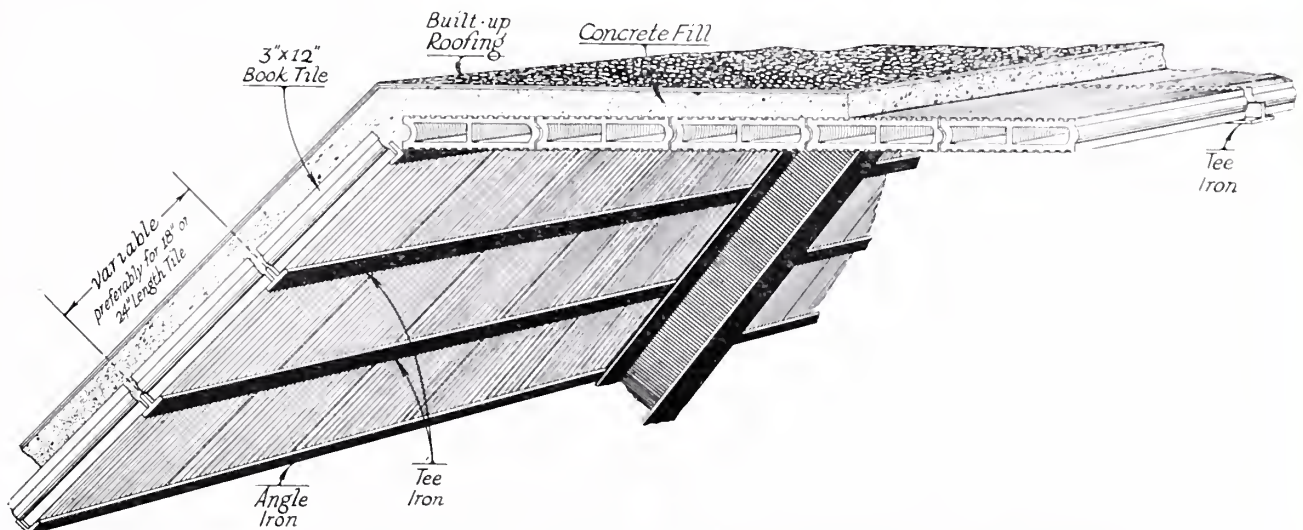


Fig. 45—Illustrating the use of standard book tile in the construction of light weight fireproof roofs.

Where a light weight fireproof roof is desired and the live load is not heavy the book tile roof illustrated in Fig. 45 is ideal. The tile are laid on properly supported "T" irons spaced to accommodate the length of tile used. Where the space between trusses is too great to permit of the light "T" irons being placed horizontally,

as illustrated, they may be laid with the pitch of the roof and rested on purlins reaching between trusses, in which case the book tile are laid with cells horizontal.

The finished roof is laid on a filler of cinder concrete not less than two inches deep. If the roofing is to be nailed on, wood sleepers should be provided in the concrete fill.





BOOK TILE

Book Tile In Raised Floor Construction

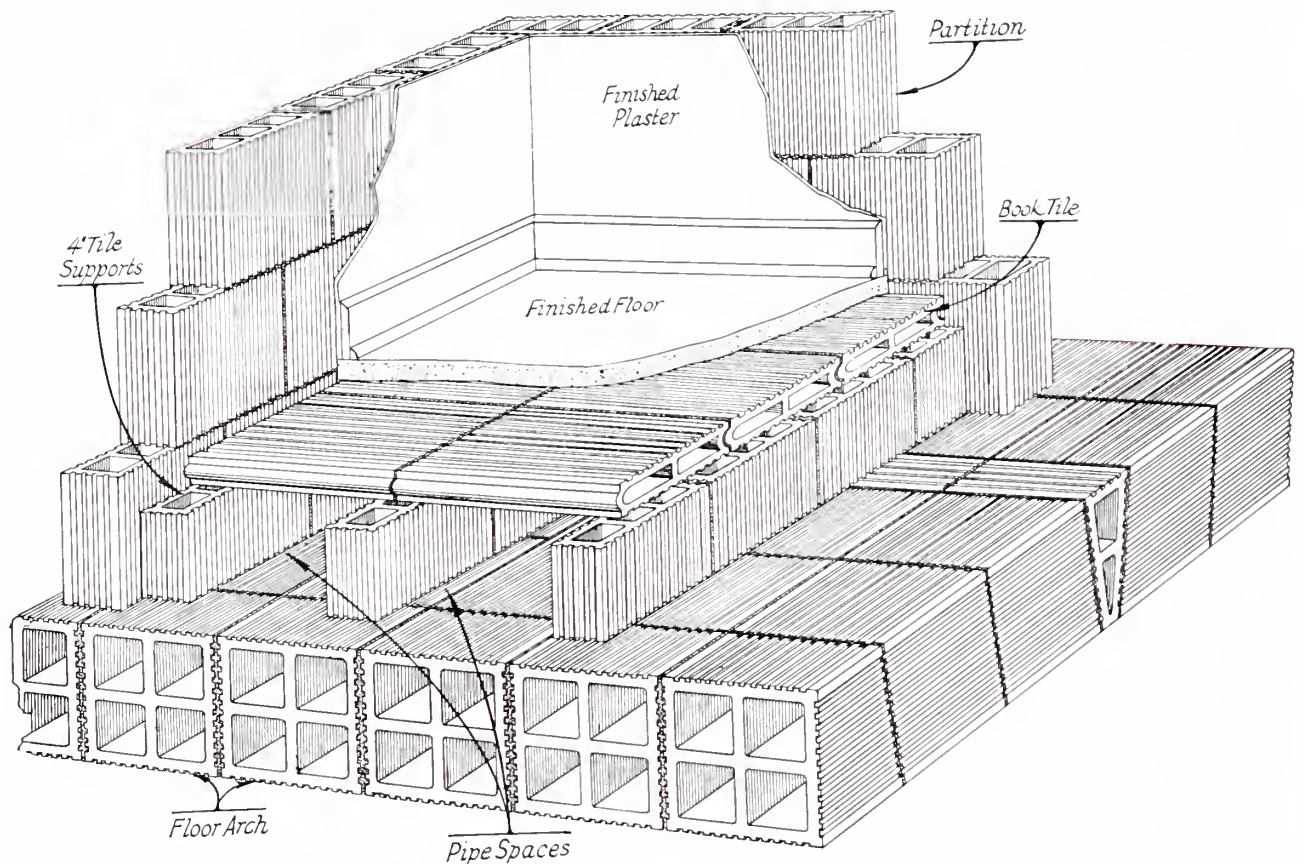


Fig. 46—Illustrating the use of book tile with partition tile supports in the construction of raised floors. Note pipe spaces provided between supports.

Where architectural requirements call for a section of floor to be raised above the level of the main floor, this is accomplished by the use of three-inch book tile resting on supports of four-inch partition tile cut to the desired length and laid on end on the main floor slab or arch. This type of raised floor is especially adapted for use in connection with hollow tile arch,

combination tile and reinforced concrete or reinforced concrete main floors as it provides a space for water and soil pipes without weakening the main floor.

A good mortar bed should be provided for the supports and for the book tile where they rest upon the supports, and a finished floor of concrete or other material on concrete base may be applied over the book tile. (See Fig. 46.)

Book Tile In Display Window Construction

In the construction of fireproof display windows, book tile are used to form the display window floor and ceiling, as illustrated in Fig. 47. The tile are laid on structural steel "T" irons spaced at equal intervals to accommodate the size of tile selected and firmly supported at both ends by structural angles of size sufficient

to carry the weight. The lower surfaces may be plastered, while the floor should be filled to the required depth with cinder concrete on which the finished floor is laid. Where the flanges of the "T" irons are of considerable width, they should be covered with expanded metal lath to form a base for plaster.



BOOK TILE Book Tile In Display Window Construction

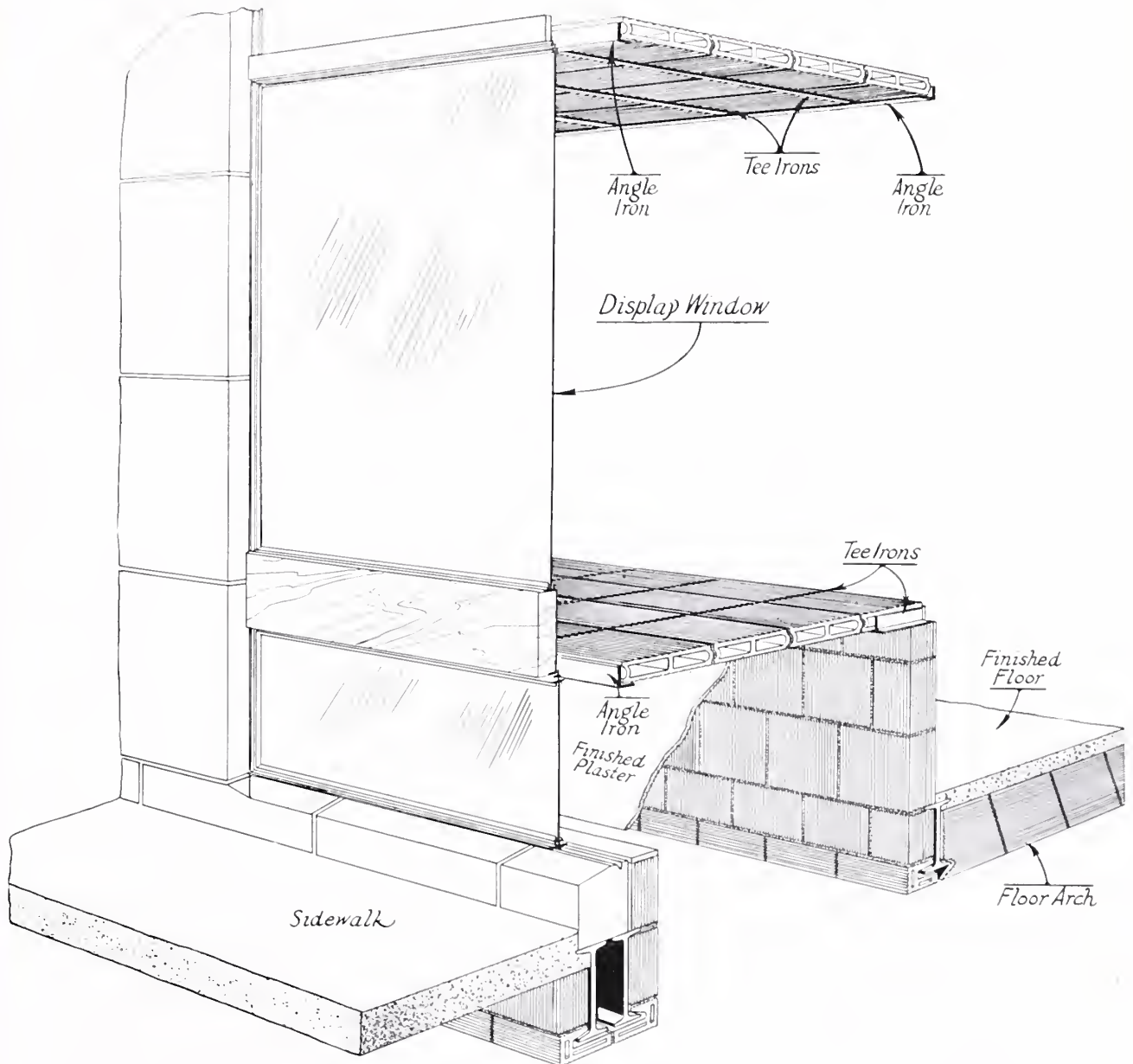
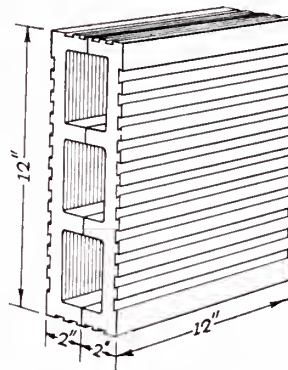


Fig. 47—Illustrating the application of book tile in the construction of display window bulkheads and ceilings.

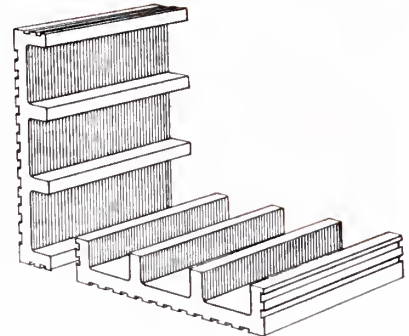
SPLIT FURRING

Uses

Split furring is used for backing solid masonry walls to prevent dampness from reaching the interior by capillary attraction and for furring out all types of interior walls to meet architectural requirements or to produce pilaster, panel or other architectural effects.



2" Split Furring
as furnished
3 cell
Wt. Approx. 9 lbs.



2" Split Furring
Ready for use
A tap of the hammer or trowel
splits the sections apart

Furring Walls

Walls may be furred to any desired thickness by the use of two-inch split furring or three-inch, four-inch or larger partition tile.

Application Split furring cannot be built free standing and must, therefore, be anchored to the main wall by the use of spikes or heavy wire ties built into the mortar joints. Where a rich cement mortar has been used in the main wall and it is found difficult to drive ordinary nails into the mortar, short heavy nails may be used with thin metal washers. A butter joint is used and mortar should be omitted between ribs and main wall.

When a furring of greater than two-inch thickness is desired, it is more practical to use either three-inch or four-inch partition tile. When the wall must be of considerable height or the furring wall is to stand free of the main wall, it should be anchored to the main wall at intervals by the use of cross walls of similar tile.

Furring around pipes or ducts is usually done with three-inch partition tile.

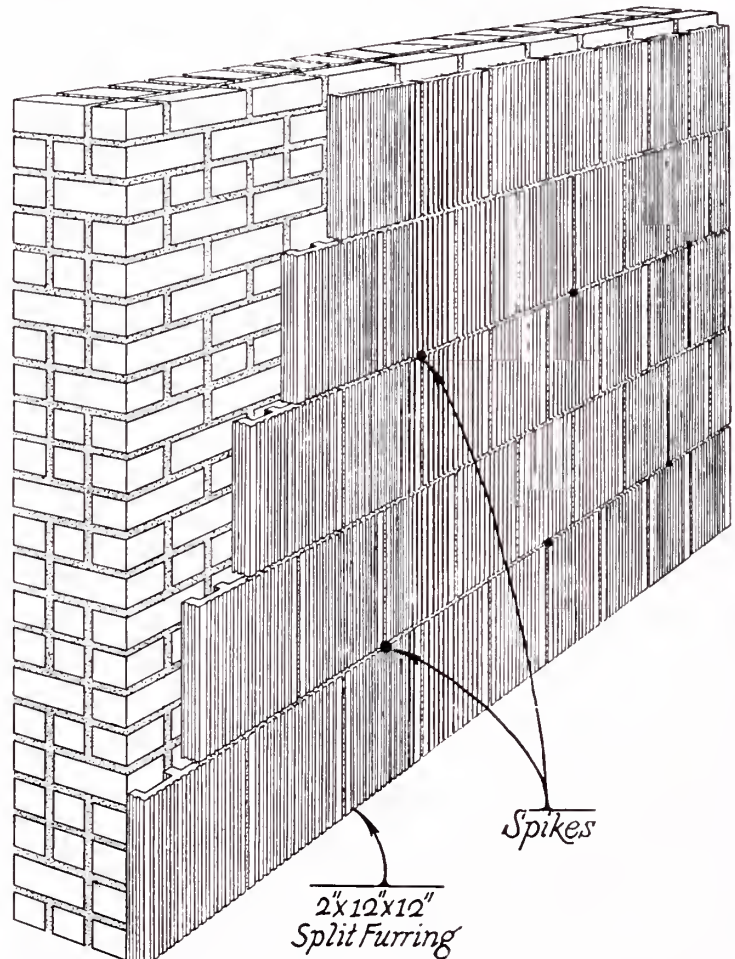
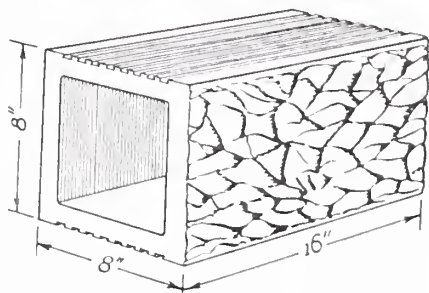


Fig. 48—Showing application of split furring to brick wall and illustrating spacing and method of spiking furring in position.

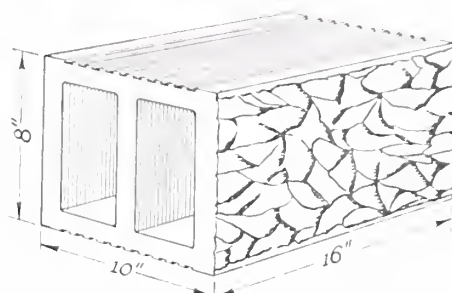




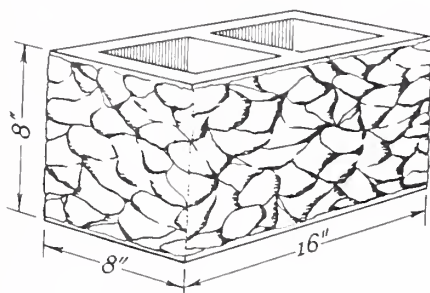
SALT GLAZED HOLLOW BLOCK



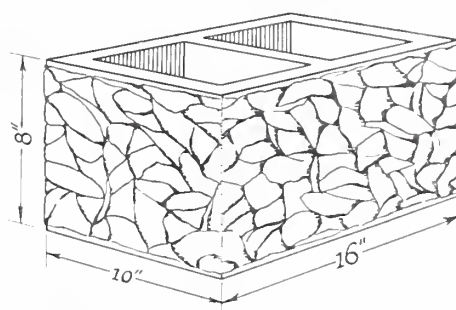
8"x8"x16" Hollow Block
1 cell
Wt. Approx. 32 lbs.



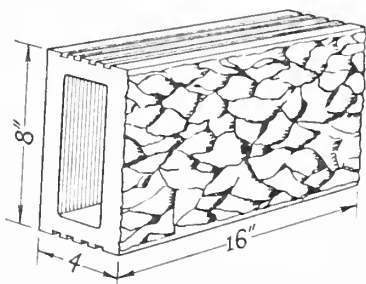
8"x10"x16" Hollow Block
2 cell
Wt. Approx. 40 lbs.



8"x8"x16" Corner Block
2 cell
Wt. Approx. 40 lbs.



8"x10"x16" Corner Block
2 cell
Wt. Approx. 46 lbs.



4"x8"x16" Hollow Block
1 cell
Wt. Approx. 22 lbs.

Uses

Hollow blocks are especially adapted for the construction of foundations for residences and other medium sized structures. They are also widely used for the walls of private garages, small factory buildings, warehouses, residences and farm buildings of various types.





SALT GLAZED HOLLOW BLOCK

Compression Test Salt Glazed Hollow Block

Conducted by Pittsburgh Testing Laboratory
Pittsburgh, Pa.

Date, June 13, 1925

Laboratory No. 54666

Mark	Weight, Pounds	Dimensions, Inches	Type—8"x8"x16", 1 cell		Crushing Load, Pounds	Crushing Strength, Pounds per Square Inch,	
			Gross Area, Square Inches	Net Area, Square Inches		Gross Area	Net Area
4	31.94	8.00x7.87x15.87	124.9	27.8	61,050	489	2,196
5	31.87	8.00x7.75x16.00	124.0	28.0	62,870	507	2,245
6	33.00	8.00x7.87x16.00	125.9	28.0	140,710	1,118	5,025
			Type—10"x8"x16", 2 cell				
			Gross Area, Square Inches	Net Area, Square Inches		Gross Area	Net Area
1	31.94	8.00x9.75x16.00	156.0	44.0	208,360	1,336	4,736
2	31.87	8.00x9.50x15.62	148.4	42.9	206,000	1,388	4,803
3	33.00	8.00x9.62x15.75	151.5	43.3	242,600	1,601	5,602

Hollow Block Walls

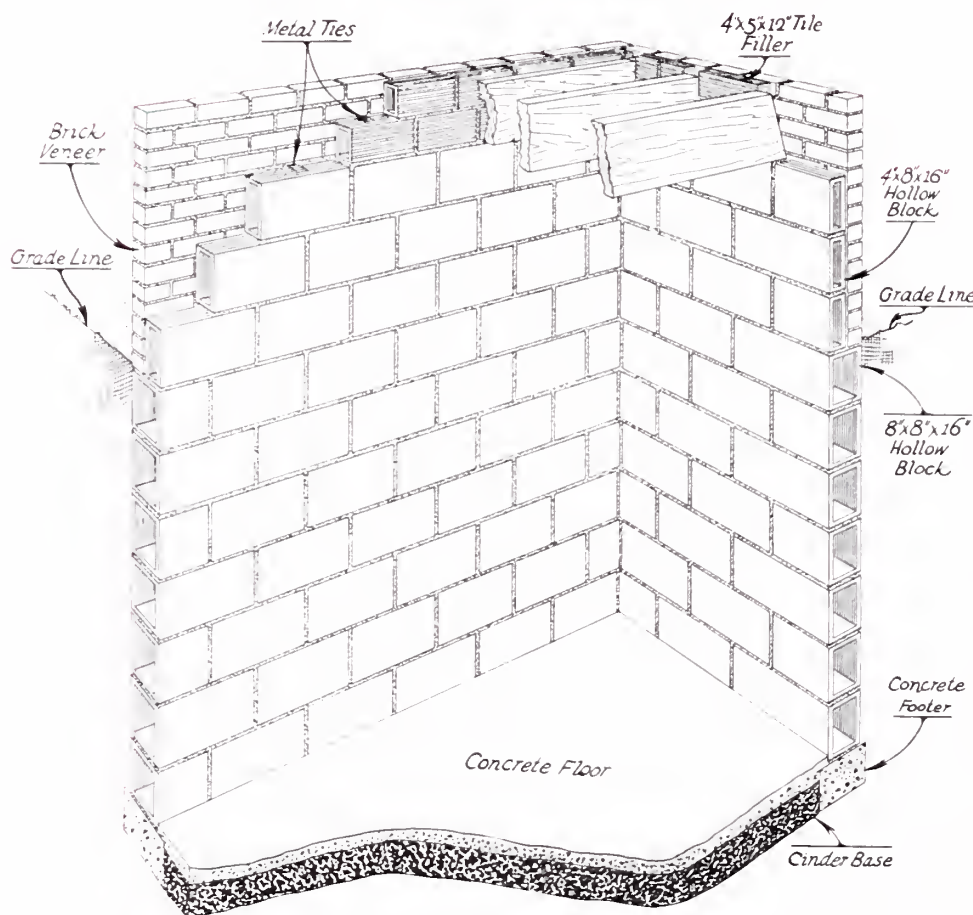
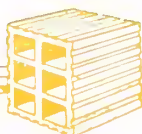


Fig. 49—Eight-inch hollow block foundation wall with brick veneer above grade, showing method of backing brick with 4"x8"x16" hollow block and filling between joists with standard backup material.

Hollow block walls are fire-resisting, durable and sanitary. They are easily laid and save mortar. Whitacre-Greer hollow block are made from high grade fire clay and are salt glazed on

all surfaces, rendering them impervious to moisture.

They are made in three sizes, 4"x8"x16", 8"x8"x16" and 8"x10"x16", with corner blocks



SALT GLAZED HOLLOW BLOCK

Hollow Block Walls

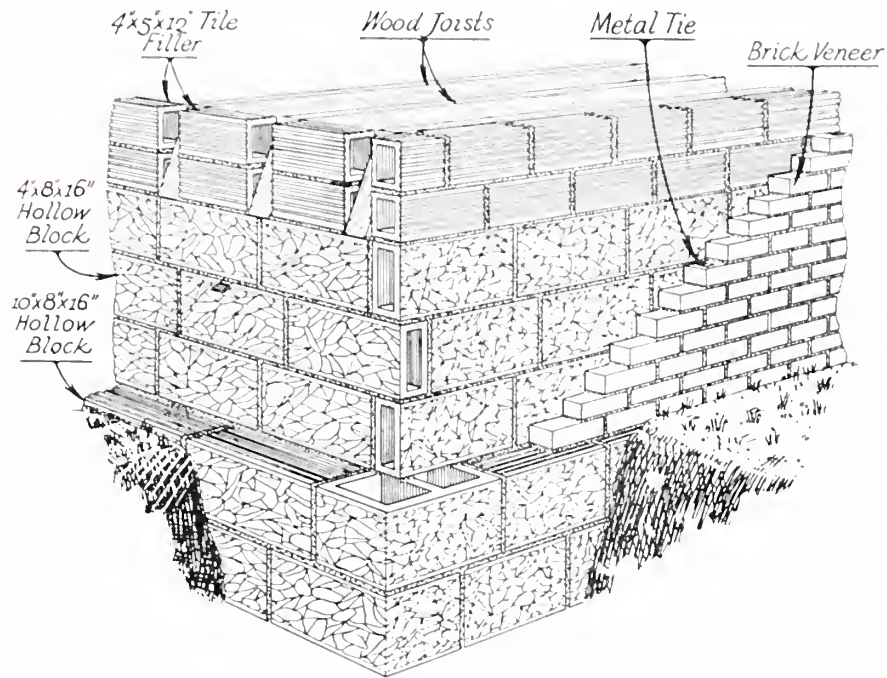


Fig. 50—Exterior of ten-inch hollow block foundation wall with eight-inch brick veneer wall above grade, illustrating method of stepping back eight-inch section and method of bonding veneer to 4"x8"x16" hollow block backing with metal ties.

for the latter two sizes and are rockfaced on one side, plain on the other and scored on the top and bottom to provide a strong mechanical bond between block and mortar.

The 4"x8"x16" size is furnished for backing brick veneer walls of foundations above the grade line, thus providing a uniform interior surface.

Foundations

Foundation walls for brick-veneer, frame or hollow tile and stucco structures may be constructed of either the 8"x8"x16" or 8"x10"x16" Hollow Block. While the 8"x8"x16" block provides ample strength for structures of ordinary weight, the 8"x10"x16" block is furnished for use where a stronger foundation is desired, the added web increasing its strength materially.

If the wall above grade is to be of face brick veneer, it may be backed with 4"x8"x16" block

tied to the masonry with metal wall ties. (See Fig. 49 and Fig. 50.)

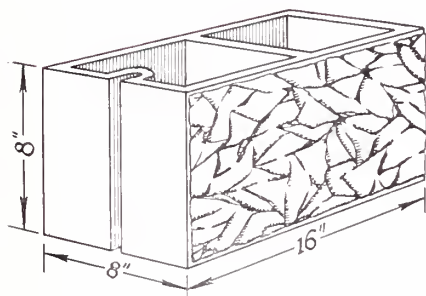
The foundation of Hollow Block should be laid on a solid footer of concrete or tile of sufficient width to give correct bearing. This will vary with the soil upon which the foundation is built.

This type of material is also employed for the interior load bearing and subdividing walls of the basement, and is extensively used for this purpose in some localities even when the foundation walls are of other materials.

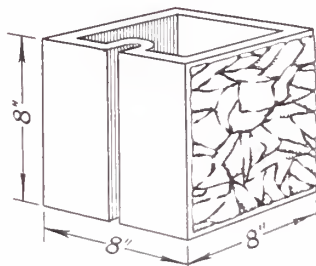




SALT GLAZED HOLLOW BLOCK Jamb Blocks For Steel Sash



Full Jamb Block
8"x8"x16"
2 cell



Half Jamb
8"x8"x8"
1 cell

Uses

The growing popularity of steel sash for all types of structures and particularly for basement windows has created a demand for a type of hollow block to accommodate this type of sash construction.

Steel Sash Construction In Hollow Block Walls

Construction Hollow Jamb Blocks for Steel Sash are furnished in full and half lengths to provide a full eight-inch running bond. On the full jamb block the rock face continues around the end opposite the sash end, producing a combination jamb and corner block.

This permits the sash opening to come as close as 16 inches from the nearest external corner.

Laying The sill is constructed of half jamb blocks laid with the grooved side facing up (See Fig. 51) to accommodate the lower flange of the sash. The jambs are laid up of half and full jamb blocks and the lintel is constructed of half jamb blocks laid with the grooved sides facing downward. The steel sash is then caulked all around with rich cement mortar or sand concrete which holds the sash firmly in place and produces a weather-proof joint.

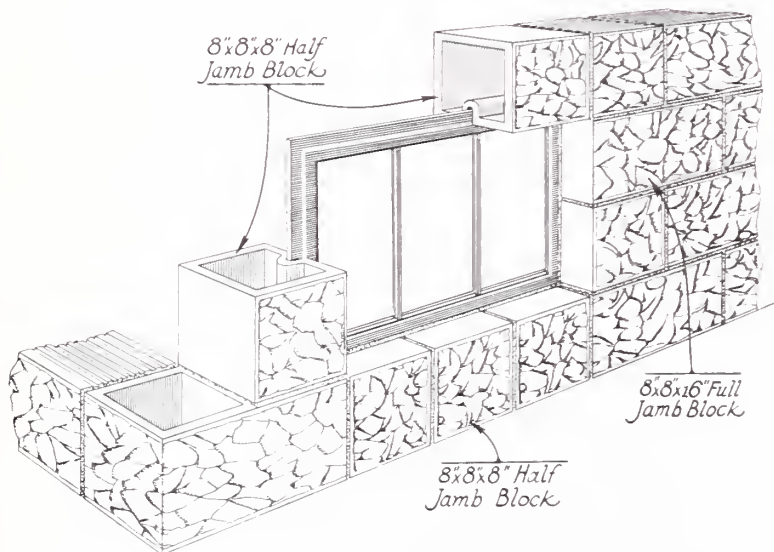


Fig. 51—Hollow block jamb for steel sash, showing lintel and sill constructed of half jamb blocks

